ROADS and STREETS

UNIVERSITY MICROFILMS R6
EUGENE B.POWER
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ANN ARBOR,MICH.
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HIGHWAYS • BRIDGES • AIR FIELDS • HEAVY CONSTRUCTION

A GILLETTE PUBLICATION

Gillette Publishing Co., 22 West Maple St., Chicago 10, Illinois • Accepted as Controlled Circulation Publication at Milwaukee, Wis.

Flagging 'em across—a mighty important task . . . page 49

Contractor's-Eye-View of His Equipment . . . page 62
Sand Embankment for Chicago's Skyway . . . page 53
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June 1958

HOBART EXECUTIVES (left to right) Robert B. Bravo, Sales Manager, Power Equipment Division; Byron A. Lutz, Director of Purchasing, All Divisions; Roger L. Frantz, Design Engineer, Power Equipment Division. Background, new "Power-Pull" Model 871 Hobart self-propelled ground power unit with Chrysler Ind. 56A V-8 engine.

why Hobart powers with Chrysler Industrial Engines

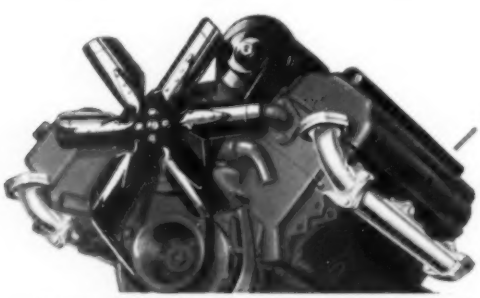
Hobart mobile ground power units are used by commercial and military airports and by aircraft manufacturers all over the world. They supply auxiliary electrical power to planes on the ground, start the plane's engines when it is ready to take-off. Two of the four Hobart models also double as towing tractors.

Demands on the engine are varied. Chrysler Ind. 56A, for example, must drive a generator at 1800 rpm's, delivering 1000 amps for continuous duty; 1250 amps for three-minute intermittent service. It must turn a jet aircraft engine up to 3000 rpm's for starting. It must operate efficiently at low speeds as well as high speeds; it must operate dependably in the frigid winters of Alaska as well as the torrid heat of Africa.

Hobart has found that Chrysler Power meets demands more efficiently, more economically and with less maintenance than any other engine manufactured—and at lower initial cost. In fact, Hobart estimates that any other engine capable of the job would cost at least 30% more and even then, could not equal Chrysler maintenance records.

HOBART MOBILE POWER UNITS come in four models; Hobart 871 powered by Chrysler Ind. 56A; Model 666, Model 869, Model 595 powered by Chrysler Ind. 32. Hobart 871 and Super 666 are built to serve as aircraft towing tractors as well as mobile power units.

SEND FOR 1958 CHRYSLER INDUSTRIAL ENGINE CATALOG: Dept. G6, Industrial Engine Division, Chrysler Corporation, Detroit 31, Michigan.



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Chrysler
INDUSTRIAL ENGINES
INDUSTRIAL ENGINE DIVISION • CHRYSLER CORPORATION

Paving the Connecticut Turnpike

Paving operations were in full swing when this picture was taken along the portion of the Connecticut Turnpike west of New Haven. Here the turnpike will be a six-lane, divided expressway of reinforced concrete, with 12-ft lanes and curves not exceeding three degrees. Grades are three per cent or less.

Bethlehem has supplied a number of road steel products for the Connecticut Turnpike, including dowel units, reinforcing bars, steel guard rail, and paving steels. In addition, many thousands of tons of Bethlehem steel piling and structural shapes were used in the construction of the turnpike's bridges and overpasses.

Bethlehem supplies a complete line of road steel products to contractors, from drill steel used in rock removal to right-of-way fence along the completed highway.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

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ROADS AND STREETS

A GILLETTE PUBLICATION • JUNE, 1958 • VOLUME 101 • NUMBER 6

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Coming Articles

Rock Excavation

Coming next month: *"Rock Drills for the Road Contractor."* The bigger, more productive drilling equipment available today is reviewed in a special Staff Report, which discusses—for the first time in any national industry publication—the factors entering into the selection of the right equipment for the job.

"Recession" Projects

How the state highway departments are springing into action to award quick projects under the $400 million emergency fund voted by Congress in April.

Equipment Maintenance

The mechanical maintenance set-up of S. J. Groves & Sons Company, multi-state highway and heavy construction contractors, will be covered soon in a special report.

Expressway Operation

Notes on the new problems of design, construction, maintenance and traffic operation of inter-city express highways, as aired recently in a regional Seminar of the Institute of Traffic Engineers at Columbus, Ohio.

Also Soon—

Winter Methods Series: How an Illinois toll road bridge was built in winter under plastic sheeting and tent . . . The winter's accomplishments along the 187 mile Illinois toll road project . . . How contractors helped rescue Michigan City from the century's worst blizzard.

MOVING 47 MILLION YARDS TO BUILD DRY-LAND RAILROAD

ACROSS GREAT SALT LAKE!

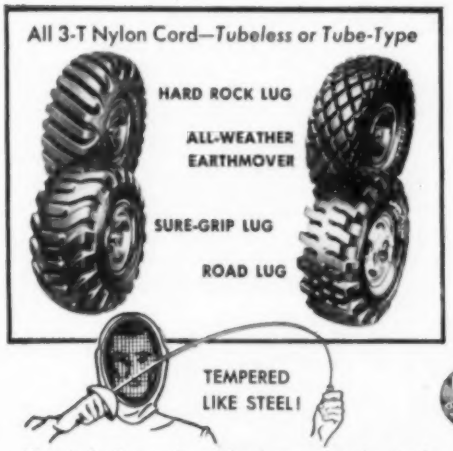
TIRE MAINTENANCE A MUST — on-the-job experts, on 24-hour call, help keep the fleet rolling. Strategically located, well-equipped, well-manned service like this cuts down time to a minimum wherever Goodyear helps jobs roll.

HERE, MORRISON-KNUDSEN has 600 men and a $15,000,000 array of tools at work "converting" salt water into road-bed. End dump trucks—bottom dump trucks—plus barges, dredges, conveyor belts and electric shovels—are high-balling a causeway 13 miles long, 180′ to 480′ base-width and as much as 70′ above lake-bottom footing. At left is one of these trucks, picking up riprap from borrow. Tires are Hard Rock Lug by Goodyear.

Triple-Tough 3-T Nylon Cord—

*the **extra** durability **exclusive** with*

Off-The-Road Tires by Goodyear!



Like steel, tire cord must be *tempered* to be tough. Goodyear's exclusive process, involves *Tension, Temperature and Time, triple-tempers* cord to make it TRIPLE-TOUGH—for longest tire life, lowest cost-per-yard.

From treads to beads, Goodyear off-the-road tires bring you the most advanced and experienced design, engineering and construction known today.

High among Goodyear's exclusive advancements is TRIPLE-TOUGH 3-T NYLON CORD—called the greatest tire *saver* in 23 years.

Only Goodyear off-the-road tires have it—yet they cost no more than other makes built with ordinary Nylon cord.

And on-the-job savings have been spectacular—on some of the toughest jobs on earth!

Try TRIPLE-TOUGH 3-T NYLONS on *your* toughest jobs. You'll agree that "Goodyear is There"—in every way! Goodyear, Truck Tire Dept., Akron 16, Ohio.

Buy and Specify

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

All-Weather, Road Lug, Sure-Grip—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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CLEVELAND TRENCHERS

DIG CLEAN

• to exact width and depth specifications
• to perfect grade
• straight and fast

SAVE MORE

• on backfill material
• on hand finishing
• on right-of-way damage

MAKE MORE

• by higher production in all soil conditions
• with lower cost for all trench work

CLEVELAND 80W

LAYS PIPE
• large capacity side boom
• long reach

FILLS TRENCH
• fast, clean
• from either side

TAMPS FILL
• to compaction specs
• simultaneous with backfill

Before you bid your next job contact your local Cleveland distributor

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good Everywhere

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ROADS AND STREETS

Devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations; the construction and maintenance of airports. Represents 66 years of continuous publishing in the highway field; combined with Engineering and Contracting and Good Roads Magazines, established in 1892.

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Move up to King-size profits

K370 1¾-yard shovel-crane delivers 16% or more output than 1½-yard rigs

There's good reason volume producers move up from 1½ yeard shovels and draglines to Link-Belt Speeder 1¾ yard machines and write new production records. Here's why:

1. 16% more bucket capacity offsets the slight added cost of "buying up" to the 1¾ yard K-370.

2. Fast—maneuverable as many smaller machines because of Speed-o-Matic power hydraulic controls and hydraulic power steer.

3. Produces as much as many 2-yard rigs because of the power hydraulic controls and bonus usable horsepower.

Move up to a 1¾ yard K-370 . . . cut your per yard cost . . . improve your competitive position . . . put yourself in line for King-size profits.

For details on the K-370 and its 3-yard mate (K-608) see your distributor or write Link-Belt Speeder Corporation, Cedar Rapids, Iowa. 14,896

LINK-BELT SPEEDER

It's time to compare . . . with a Link-Belt Speeder

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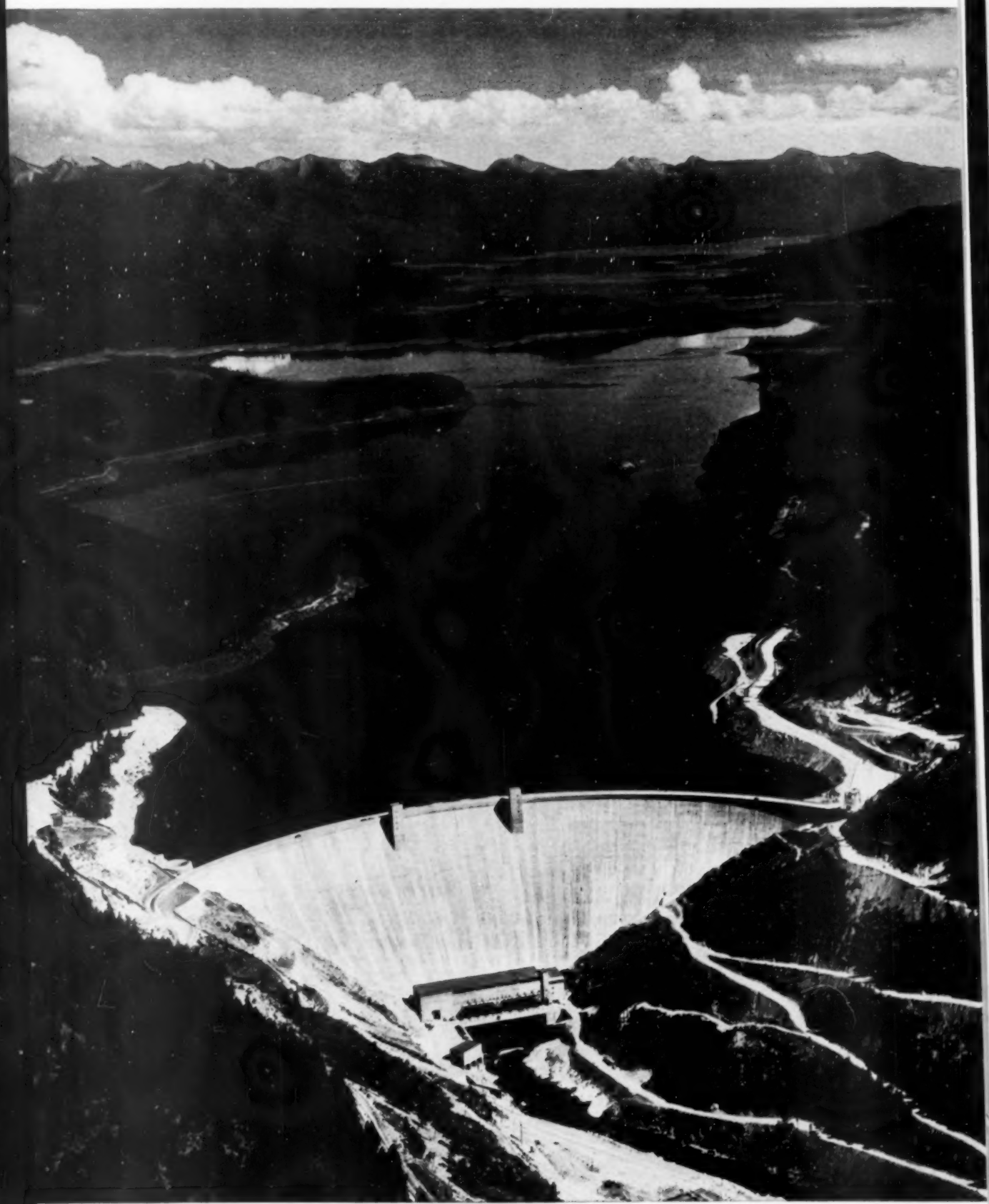
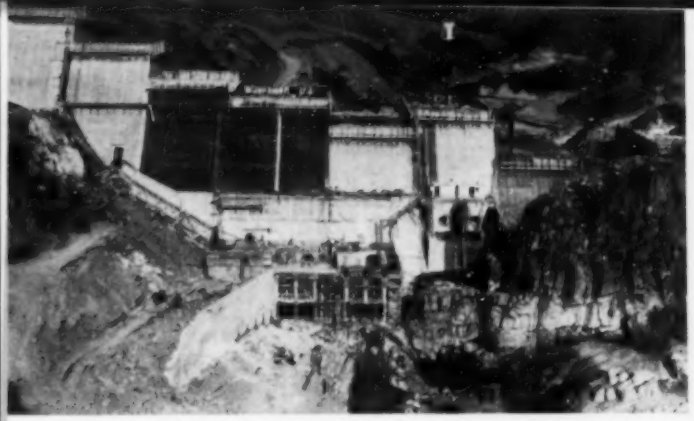
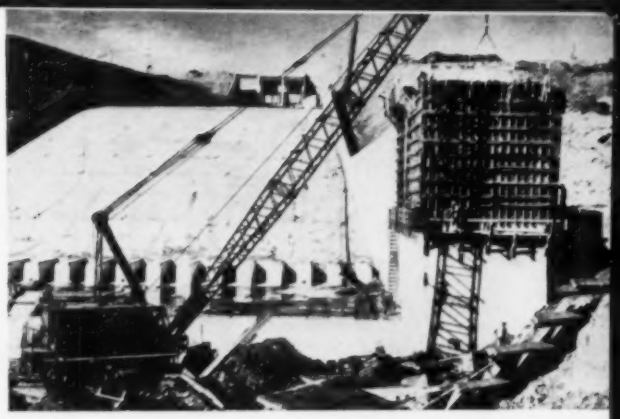
HUNGRY HORSE DAM, MONTANA. TEXACO PLAN PLAYED VITAL PART IN ON-TIME PROJECT COMPLETION.





TEXACO PLAN was used from the start in construction of the Tiber Dam on Montana's Marius River. Dam is 205 feet high and 4,300 feet long.



TIME AND CONFUSION SAVED by Texaco Plan kept maintenance costs low during construction of Tulloch Dam in California.

These 5 great American construction projects use **Texaco Simplified Lubrication Plan**

These five projects represent hundreds of millions of dollars in construction costs. When you hit these figures, lubrication can be an especially big item. But on any size job, it's not the cost of the lubricants themselves but the difference between *planned* and haphazard lubrication methods that counts. The latter can cause unexpected breakdowns, costly overtime, and ruined equipment. But planned lubrication can speed project completion, minimize downtime, lengthen equipment life. That's why cost-conscious contractors are turning to Texaco's Simplified Lubrication Plan.

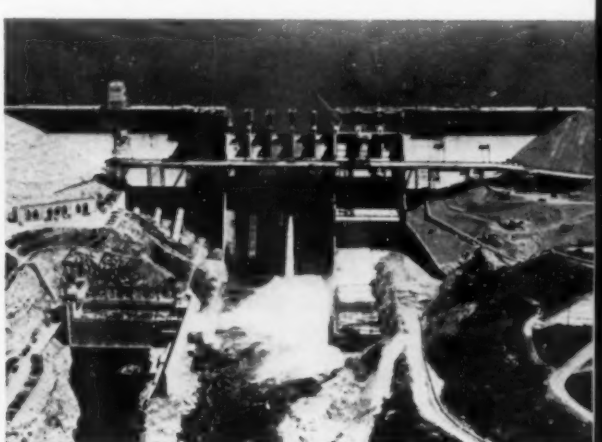
TEXACO PLAN SAVED THOUSANDS OF DOLLARS on these jobs. And it can do the same for you. It cuts the number of lubricants you need for all your major lubrication down to no more than six, and it helps you set up an efficient lubricating system for all your equipment. Furthermore, your Texaco Lubrication Engineer will gear the Texaco Plan to your particular requirements.

GET THE WHOLE STORY. Contact your nearest Texaco Lubrication Engineer *soon*. He can show you how much the Texaco Simplified Lubrication Plan has saved contractors in the past—how it can help you in the future. Just call the nearest of more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

WELL AHEAD OF SCHEDULE, Columbia River's Priest Rapids Dam is already more than one-third complete. Texaco lubricants are used exclusively.



WORLD'S LARGEST earthfill and concrete project, Folsom Dam on the American River, used the Texaco Simplified Lubrication Plan from start to finish.

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Pick the JOY COMPRESSORS

that fit your work

you'll save MONEY on AIR

Right now is the season for your CONSTRUCTION AHEAD, and right *now* is the time to take an honest look at the compressors in your yard. If they are tired, unhealthy or too weak to do the work your schedule calls for . . . talk to the Joy Distributor about his lineup of Joy Airvane Rotary Portables.

In the first place, Joy Airvanes are built in a complete spread of power: 125, 250, 365, 600 and 900 cfm models; and they are equipped with Joy Servair Demand Control that exactly matches output to demand from 0% to 100% capacity. Servair runs the engine just fast enough to meet the need; saves you fuel bills and compressor wear and tear.

Secondly, you purchase complete compressor *reliability* when you buy Joy Airvane Rotaries . . . Don't take our word for it, ask your Distributor to put you in touch with other contractors who have them on the job . . . you'll be surprised how Joy Airvane owners brag at the way Joy saves them money on air.

Want the name of your nearest Joy Distributor? Write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Reliability is a must on any job. The "work horse" ability of the Model RP-900, shown here with a JOY TWM-5, is typical of all the Airvane Rotary Portables.

Write for Free Bulletin 241-86

JOY Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.

EQUIPMENT FOR CONSTRUCTION

PORTABLE AND SEMI-PORTABLE AIR COMPRESSORS • ROCK DRILLS • TRAC-DRILLS • DRILL BITS • BACKFILL TAMPERS • SPADERS
PAVING BREAKERS • SHEETING DRIVERS • DRIFTERS • PORTABLE HOISTS • FANS AND BLOWERS • PORTABLE SAFETY LIGHTING

WBW-C7158-241

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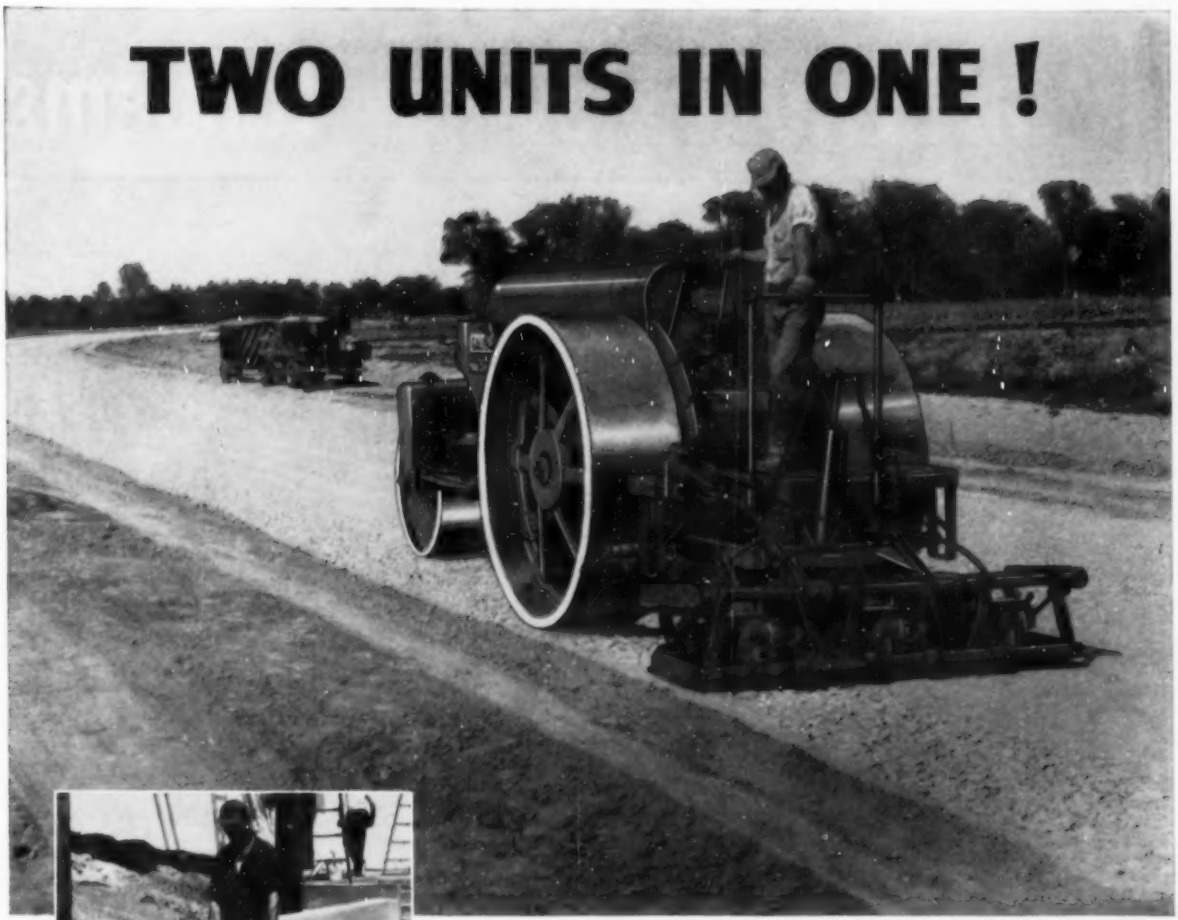
TWO UNITS IN ONE !



GALION 3-Wheel Roller with Electric VIBRATORY COMPACTOR

A "Chief" or "Warrior" model Roller with Jackson Vibratory Compactor accomplishes both static and dynamic compaction. You get the compressing action of massive roller weight plus the consolidating action of vibration (4200 three-ton blows per minute).

So effective is this double compaction effort, the most rigid State and Federal density specifications (including Proctor, Modified Proctor, and AASHO-T99-49) are often attained in ONE pass per lift. It leaves a smooth flat surface—no waves or "washboard" effect.

This combination SAVES YOU MONEY!

By eliminating one machine and one operator, you save on labor costs and on equipment investment. You save on lower overhead, operating time and expense.

MULTI-PURPOSE USE!

Individual compactor units of the Jackson Electric Vibratory Compactor may be detached and used as manually-guided, self-propelled compactors for confined areas inaccessible to multi-unit machines.

Compactor power unit can be used as a lighting plant or for operation of small power tools.

Write for literature.

THE GALION IRON WORKS & MFG. CO.
General and Export Offices, Galion, Ohio, U.S.A.

GALION
ESTABLISHED 1907

MOTOR GRADERS & ROLLERS

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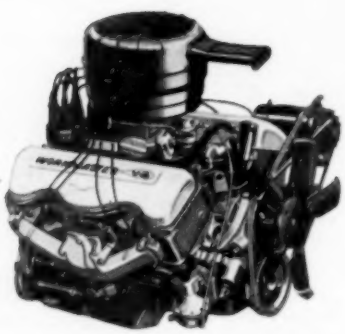
CHEVROLET'S new tandems

Unique design advantages . . . special work-whipping features . . . these are the things that make Chevrolet tandem models the trucks best able to do big jobs the way you want them done!



NEWEST BIG-TRUCK POWER

Chevrolet's broad-shouldered six-wheelers are tops for high-profit hauling on the big, tough jobs! Triple-Torque tandem models in Series 80 and 100 are specially engineered to haul king-sized payloads—and keep costs down while doing it! G.V.W.'s go all the way up to 36,000 lbs. And there's plenty of power, too. Standard in 80 Series is the new 175-h.p. Heavy-Duty Super Task-master V8. Its short-stroke design means more pulling power per pound. Chevy's revolutionary new Work-master V8 is standard in Series 100 tandems. With 230 h.p., 348 cubic inches of displacement and new Wedge-Head design, the Workmaster stays and saves on heavy-weight hauling jobs with a new kind of hustle!

CHEVROLET

CHEVROLET

are built to beat big jobs!

SPECIAL DO-THE-JOB FEATURES

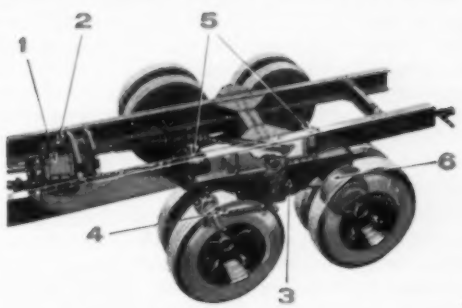
1. Chevrolet's exclusive TRIPLE-TORQUE DRIVE is provided by individual propeller shafts driven by the power divider with integral 3-speed auxiliary transmission.

2. Integral 3-SPEED POWER DIVIDER can be shifted instantly to single axle drive for economy or dual axle drive for full traction on or off the road.

3. The Triple-Torque tandem's articulated WALKING BEAM assures owners of greater ground clearance . . . the utmost flexibility for operation on rough terrain.

4. "TRACKING" WHEELS, because of Chevrolet's rubber-bushed steering torque rods and walking beam ends, stay in alignment on straight roads, follow curves. Increase tire life, driver control.

5. Two built-for-work 15,000-LB.-CAPACITY AXLES with 7.20 to 1 ratios! Choice of front axles . . . 7,000-lb. capacity standard or 9,000-lb. capacity optional at extra cost.



6. BIG TWIN-ACTION BRAKES are designed to last! Extra braking power with heavy-duty Hydrovac power brake. Full-Air or Air-Hydraulic brakes optional at extra cost.

Let your Chevrolet dealer show you these, and the many more exclusive tandem features designed to get your big jobs done quickly, dependably and economically! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

TASK·FORCE TRUCKS

. . . for more details circle 275 on enclosed return postal card

Digs 12½ feet deep

16 TO 42 INCHES WIDE

loads trucks • dodges poles hugs curbs • makes vertical set-ins • undercuts walks

For all its size and heavy-duty strength, Parsons 250 Trenchliner is completely flexible, meets a wide range of job requirements. 30 digging speeds let it "inch" its way past cross-pipes and other underground obstructions — or dig up to 9¾ lineal feet of trench per minute on open-country work. Sloping ladder boom undercuts sidewalks, sewers, existing mains, or makes vertical set-ins flush against foundations or building walls — saves hand clean-up.

Shiftable boom cuts within 12 inches of side obstructions, digs as efficiently behind either crawler as it does in center position. Spoil conveyor power shifts completely through the Trenchliner in less than one minute — dodges trees, poles and buildings without swerving from grade line. Belt direction is instantly reversible, dumps right or left. Arc of conveyor gives low-level, close-to-trench deposit — or reaches up to 6 feet-8 inches to load trucks (8 ft.-6 in. with conveyor extension section).

Check what this flexibility can mean in more feet of trench per day, and lower cost per foot, on your jobs. Let Parsons distributor give you full details on this heavy-duty 250 Trenchliner® or send for catalog.

Write to: **PARSONS CO., Newton, Iowa**

NEW size added to Parsons line

Look at the low profile of this small Trenchliner! It's the new 155 — compact, low, and narrow. Working height is only 7 feet-4 inches. Width over crawlers is 5 feet-4 inches. It digs from 5.8 inches to 25 feet of trench per minute — 16 to 26 inches wide, at depths to 10 feet. Has all the heavy-duty characteristics of larger Trenchliners. (Other Parsons sizes range from a small rubber-tired Trenchmobile® to "big-inch" and "middle-inch" trenchers.

P637REV

Division of Koehring Co.

CHECK PARSONS FOR TRENCHES 8 INCHES TO 6 FEET WIDE . . . DEPTHS TO 17 FEET

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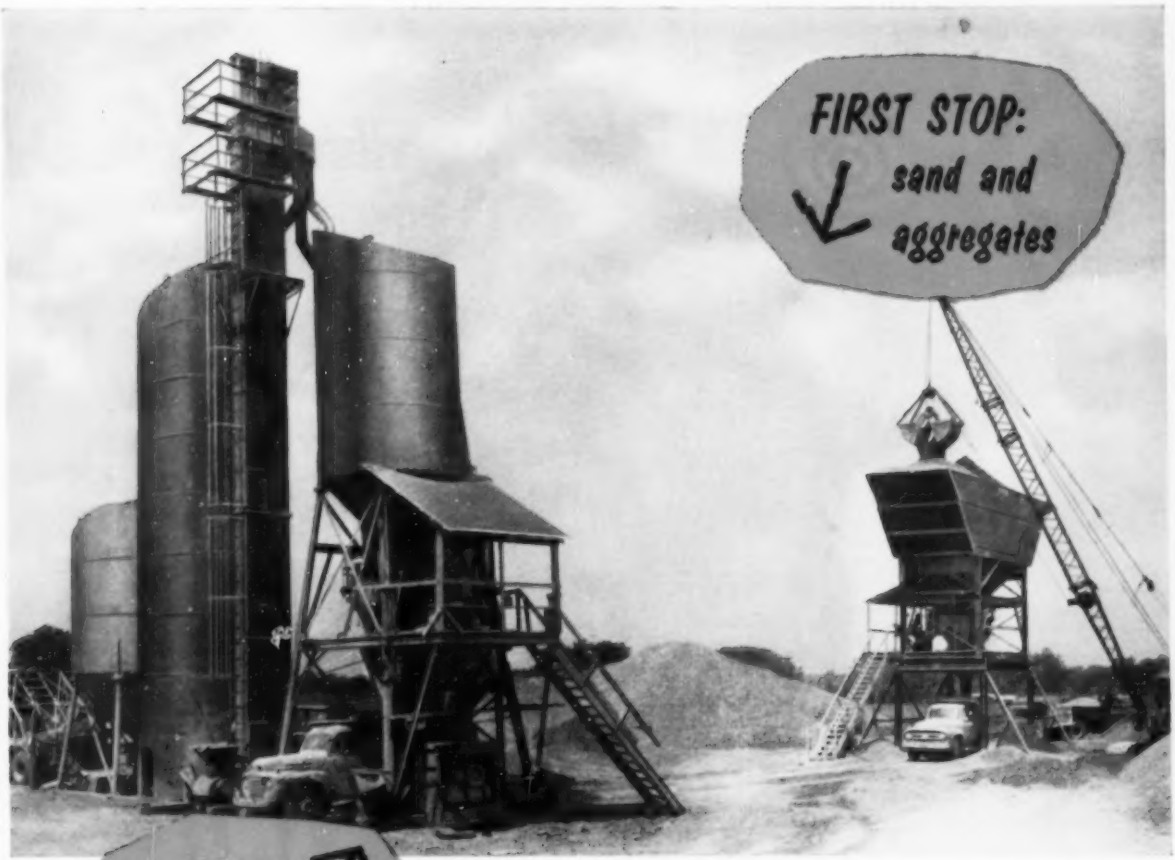

On paving operations, costs and overall efficiency are very often determined at the batching end of the job, where a dependable, high rate of production and rigid specifications must be maintained. That's why experienced contractors install Johnson automatic batch plants, like the two-stop set-up shown here.

At the first truck stop, sand and two aggregates are loaded from 120-cu. yd. All-Purpose Bin. This aggregate plant takes any arrangement of single-material batchers, or one or two multiple-material batchers, sized for 34-E paver operation. Automatic push-button control maintains fast batching cycles, with pin-point weighing accuracy of every batch. What's more, with Johnson's graphic pen-recording system, there's *direct transmission* of weight from batcher-to-dial-scale on the control cabinet. You're always *sure* of a correct batch weight *and record,* to conform with the most rigid job specifications. Similar graphic recording and automatic batching at the bulk cement plant assures fast, accurate weigh-out at the second truck stop. This second plant, with its elevated and auxiliary ground storage silos, takes one or two 1000-lb. cement batchers, has big-capacity screw conveyor, bucket elevator and receiving hoppers for truck or rail delivery of cement.

Read all about it in the brand-new 36-page textbook catalog, which covers all phases of paving plant operation. It shows typical plant sites; takes you on "tour" through all types of Johnson 1, 2, and 3-stop plants; explains latest developments in plant automation, etc. It's yours for the asking. Contact Johnson distributor, or send coupon for your copy *today.*

C. S. JOHNSON CO., Champaign, Illinois
Send us free "Concrete Paving Plants" catalog

NAME_____
TITLE_____
COMPANY_____
STREET_____
CITY, STATE_____

J758 RS

JOHNSON CONCRETE PRODUCTS

C. S. JOHNSON CO., CHAMPAIGN, ILL. (Koehring Subsidiary)

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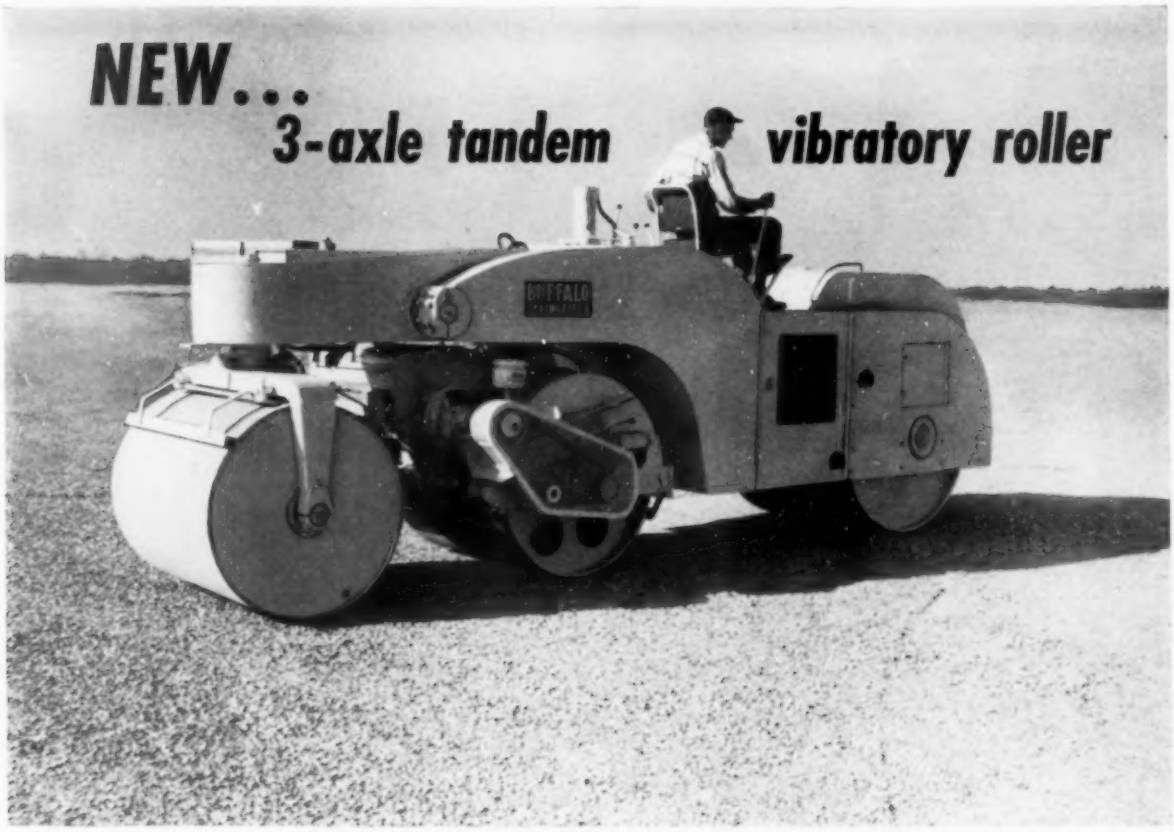
NEW... 3-axle tandem vibratory roller



PERFORMANCE REPORT — At a new airbase, 3-axle tandem vibratory roller was tested on 6-inch lifts of crushed, bank-run gravel, to which mineral filler and slag had been added. Result: over 100% density in not more than 3 passes.

CONCENTRATES 2,000 TO 2,800 VIBRATIONS PER MINUTE WITHIN CONTROLLED AREA

Greater densification of materials with fewer passes . . . compacts deeper lifts of material

Now, Buffalo-Springfield brings you a sensational new development in vibratory compaction, that concentrates all vibrations within a *confined* ground area. That's because the vibrating roll is in the *center* position on the new Buffalo-Springfield® KX-25EV. End guide roll, and the drive roll maintain full surface contact at *both* ends of the roller — and allow no vibrations to escape or dissipate beyond these contact points. All vibratory effort is exerted in a *downward* direction.

A separate engine, mounted on a sub-frame on the center roll, transmits power through V-belts to an eccentric axle shaft, which runs through the center roll. Eccentric shaft turning at high speeds creates a vibrating action on the roll. Normal operating speed — 2,000 to 2,800 vibrations per minute. Unit is controlled from the operator position. Rate of vibration is regulated from same position through throttle control cable. Center roll revolves freely on eccentric shaft, regardless of vibrations per minute, to match roller travel speeds.

Retains "walking-beam" feature

When vibrating action is not required, the independent power unit is merely turned off — and the KX-25EV becomes a standard 3-axle tandem with exclusive "walking-beam" compaction control! *And that's not all.* Hydraulic control raises the center roll, to operate machine as a long-wheelbase 15-20 ton 2-axle tandem. You've never seen anything like it — a vibratory roller, a 3-axle tandem with "walking-beam" compaction control, and a 15-20 ton 2-axle tandem — all in *one* machine. For more detailed information call Buffalo-Springfield distributor.

B802-N

BUFFALO-SPRINGFIELD ROLLER CO.
SPRINGFIELD, OHIO • DIVISION OF KOEHRING COMPANY

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Replaces power shovel with 4-In-1

...gets versatility unlimited!

Digging, 'dozing, clearing, loading—this International Drott TD-9 4-In-1 replaces the limited-duty performance of a ⅜ cu. yd. power shovel. Tony Pacifico Company, Charleston, W. Va., practically builds a 100-ton-per-hour stone-quarrying operation around 4-In-1 versatility. Above, using bulldozer action, the 4-In-1 is removing overburden from a 60-foot-thick rock stratum. Owner formerly had to hire a dozer in addition to the power shovel to clear and strip!

Using a back-drag motion of the clam lip, with high-reaching 4-In-1 clamshell action, the Pacificos do a fast, low-cost job of bank-sloping—to forestall earth slides into the quarry. The exclusive, big-capacity clamshell also gives speedy "stand-and-fill" action of loose materials.

Pushing over a hardwood sapling, the Pacifico 4-In-1 is used for land-clearing ahead of stripping quarry overburden. For uprooting larger trees, a grubber blade can replace the 4-In-1 bucket—to apply the tremendous lifting power of exclusive Drott pry-over-shoe break-out action!

Sticky clay dumps clean—quits gumming the works and slowing overburden removal when the Pacificos use 4-In-1 clamshell bottom dumping. Opening the clam pulls sticky materials from bucket surfaces—gravity pull does the rest, to give the 4-In-1 positive self clean-out!

Prove 4-In-1 four-machine versatility unlimited! Move the machine-selector lever—try the built-in *clamshell, "carry-type" scraper, bulldozer and Skid-Shovel* actions. Compare exclusive pry-over-shoe break-out action for digging hard materials other rigs can't budge! See how exclusive Hydro-Spring swallows shock, protects performance. Ask your International Drott Distributor for a 4-In-1 demonstration.

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®

Send for free catalog today

International Harvester Company
180 North Michigan Ave., Chicago 1, Illinois

Gentlemen:
Please send 4-In-1 catalog literature checked:

☐ 1-yd. TD-6 (CR-640-H) ☐ 1½-yd. TD-9 (CR-627-H) ☐ 2¼-yd. TD-14 (CR-635-H) ☐ 3-yd. TD-18 (CR-632-H)

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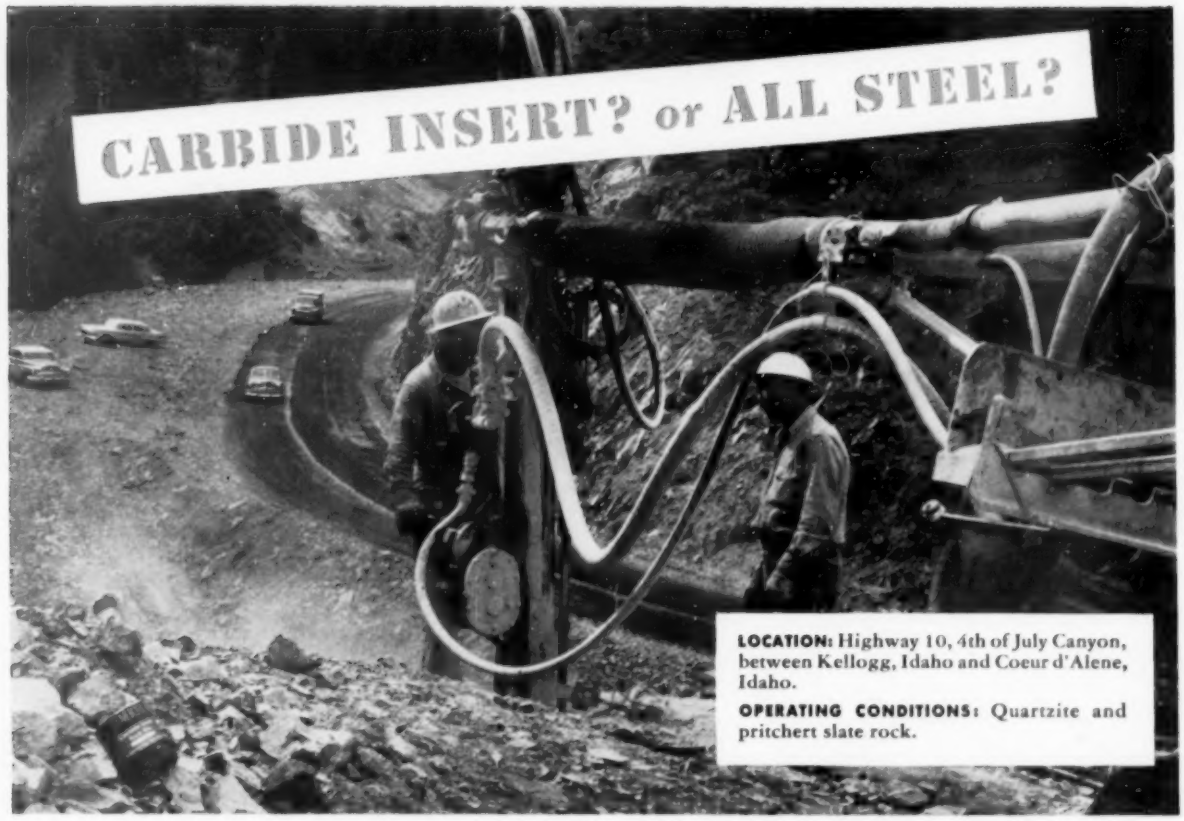
CARBIDE INSERT? or ALL STEEL?
LOCATION: Highway 10, 4th of July Canyon, between Kellogg, Idaho and Coeur d'Alene, Idaho.
OPERATING CONDITIONS: Quartzite and pritchert slate rock.

"We get more re-grinds per bit, lower cost with TIMKEN® carbide insert bits"

. . . Reports F. H. Slate and E. C. Hall Co.

IN constructing 7.2 miles of new four-lane highway in 4th of July Canyon between Kellogg, Idaho and Coeur d'Alene, Idaho, F. H. Slate and E. C. Hall Co. must drill through quartzite and pritchert slate rock. Using Timken® carbide insert bits, they average 12 to 14 re-grinds per bit, drill 20 to 100 feet of blast hole per pass. And with proper grinding, they use all of the carbide height with no fracturing of carbides when discarded. Bit cost per foot-of-hole stays at the minimum, production at the maximum.

Timken carbide insert bits are your best bet, too, for drilling in hard, abrasive ground. But in ordinary ground, you should use Timken all steel multi-use bits. They're interchangeable in the same thread series. Without changing drill steels, bits can be changed quickly and easily as the ground changes.

All Timken rock bits are made from our own electric furnace fine alloy steel. We're the only American removable bit manufacturer that makes its own steel. And for even longer life, Timken bits have a specially developed shoulder union that protects threads against drilling impacts.

To get all these advantages and get the right bit for your job, call or write Timken Rock Bit Engineering Service, The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

Timken threaded all steel multi-use rock bit — Timken threaded carbide insert rock bit

TIMKEN TRADE-MARK REG. U. S. PAT. OFF.

your best bet for the best bit for every job

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ROADS AND STREETS
Sixty-Six Years of Editorial Leadership

Washington News Letter

Exclusive - By Duane L. Cronk, Director, Highway Information Services

June 10, 1958

An investigation into the cost estimates submitted by the various state highway departments for construction of their national Interstate System mileage has been completed by the Comptroller General of the U.S. The Senate Subcommittee on Roads had requested this independent appraisal after serious questions were raised about the accuracy of the $40 billion estimate during hearings several months ago.

The integrity of the BPR estimate is of utmost importance, mainly because it has become the basis upon which all future federal-aid for Interstate projects will be divided among the highway departments. The comptroller stated at the outset of his report that his corps of accountants was incompetent to judge the validity of construction cost estimates based so extensively upon engineering criteria. However, they did reveal a number of aspects of the estimate not heretofore publicized.

* * *

One aspect was that the cost of 1,102 miles recently designated for inclusion in the System was not added to the total estimate. This alone is a $1 billion item. Also not included is an estimate of $490 million for administration of the program by the BPR and for highway planning surveys. Some states included amounts totaling $741 million for construction of free roads paralleling existing toll roads, an action the accountants questioned. They also found a number of errors due to mistakes in calculation or of omission.

The bulk of the Comptroller General's 103-page report, however, was devoted to an appraisal of how closely the 11 states selected for review had followed the Bureau's uniform design standards for determining their construction costs. Senator Gore, particularly, had been concerned that states were not working from a common criteria in developing their estimates. He felt that if huge sums of federal aid are to be divided among the states on the basis of their own estimates of need, such estimates should all be computed from a common standard. Obviously, if one state were permitted to "over-estimate" its needs by employing higher standards, it would receive more than its share of available federal funds, other states less.

* * *

Ohio had been accused openly of over-designing its Interstate mileage. Rumors of other alleged departures from Bureau instructions have filtered into Washington continuously during the past few months. The result has been a growing discontent among Congressmen about the construction cost estimate. The comptroller's probe into the methods employed by 11 key states will flush a lot of questions into the open.

(continued on next page)

Here are a few of the items Congressmen will seize upon to complain that (1) the estimate is too high, or (2) that the states do not intend to follow the Bureau's design criteria.

● All 11 of the states checked had estimated right-of-way widths well beyond the minimums required by the federal standards. Most of them figured wider median strips through urban areas. Their cost estimates included designs ranging all the way from 20-ft. strips to 84 ft. (the standards called for 16 ft.). Median strips in rural areas varied, too, from 36 ft. to 181 ft. although the design standards specified 36 ft. as the basis for estimating costs.

● Other design criteria - shoulder widths, bridge widths, frequency of interchanges - drawn up by the Bureau were also disregarded. Only four of the 11 departments used the Bureau's suggested procedure for projecting traffic demand to 1975.

* * *

By calculating dollar values of many of these cases of departure from the federal standards, the comptroller was able to suggest that the total multi-billion-dollar cost estimate for the huge Interstate effort may be considerably in error. This implication is bound to raise the hackles of highway engineers. For example, the comptroller implied that the 7 out of 11 states which did not follow the Bureau's suggested traffic forecasting procedure had submitted questionable estimates.

Just the opposite may be true, BPR officials maintain. E. H. Holmes, chief of the Bureau's Research Division and certainly one of the most knowledgable men in highway system development, explained that the techniques suggested to the states were general academic guides and that the state engineers were urged to follow their own judgment where local experiences differed and more specific knowledge of growth and land use indicated that their own procedures were more refined. In such states the results would be better estimates of traffic rather than poorer.

Actually, several striking impressions arise from a long second look at this review. It is encouraging that differences in state estimating methods were accepted by the BPR. This acknowledgment that the engineering judgment of state engineers with their knowledge of local conditions, may be superior to that of the federal officials is realistic and something laudable in itself. It is also encouraging that so many of the states are planning to build above the minimum standards. This, too, is more to be commended than criticized. There remains however the problem of avoiding injustices between the states in establishing the needs yardstick for allocations.

* * *

The comptroller assumed that it was the intent of Congress that the state highway departments should plan to build to a uniform standard and to submit their cost estimates on that basis. This is not the recollection of most observers. Most Congressmen do not entertain such a passion for "uniformity."

The objective is to have by 1975 not a system of identical highways, but a network whose individual segments are adequate for the traffic load imposed upon them. The BPR clearly stated that its design criteria were minimum standards, and "uniform" only in the sense that America needs a system that is uniformly adequate. There would be considerable more cause for concern if the states had estimated their costs on the basis of theoretical minimums, rather than on the basis of what they know they must build.

B.F.Goodrich

B.F.Goodrich Rock Service tires speed highway construction for contractor

CKG ASSOCIATES put 115 pieces of equipment on the job to speed completion of the Northern Illinois Toll Road near Elgin. Trucks, tractors, earthmovers, cement-mixing machines —all work 12 hours a day, 6 and 7 days a week. Helping this equipment stay on schedule are 8 different types of B.F.Goodrich tires, headed by the new Rock Service Tubeless. Fast, expert on-the-job tire service given by the local B.F.Goodrich dealer is one reason for this choice.

Another is outstanding tire performance. The new B.F.Goodrich Rock Service tire is built to its inflated shape. The whole tire flexes evenly—no *localized* stresses that often cause unnecessary tire failure. The B.F.Goodrich FLEX-RITE NYLON cord body withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. Result: more retreadable Rock Service tires.

The Rock Service double chevron tread gives maximum traction. Rugged sidewalls defy rock bruises. And B.F.Goodrich Tubeless construction is available. It protects against punctures, cuts maintenance costs, is easier to service. Tires run cooler.

See B.F.Goodrich Rock Service Tubeless or conventional tires at your nearby B.F.Goodrich dealer, who is listed under Tires in the Yellow Pages of your phone book. He has a money-saving tire for every construction job. *B.F.Goodrich Tire Co., A Division of The B.F.Goodrich Co., Akron 18, Ohio.*

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

B.F.Goodrich *truck tires*

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Phillips *66 individual service* can make your operation more profitable. A Phillips *66* Lubrication Engineer will consult with you right on the job. He will make recommendations for the *right* fuels and lubricants, and have them available on the job when you need them.

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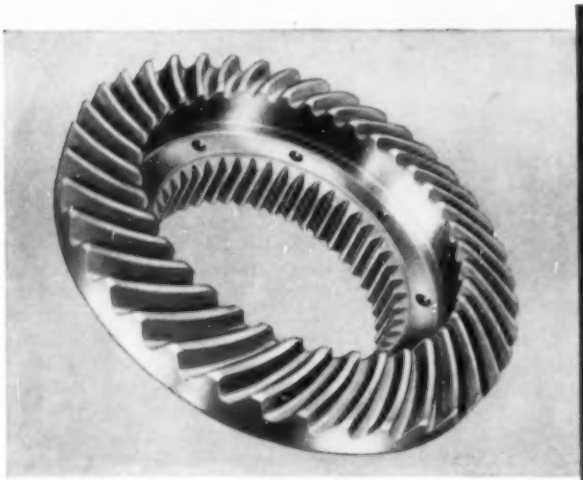
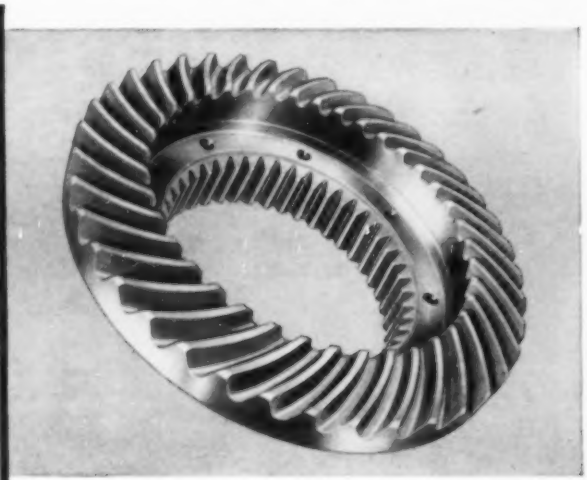


Replacement Ring-Gear
Made by Eaton—Axle Division



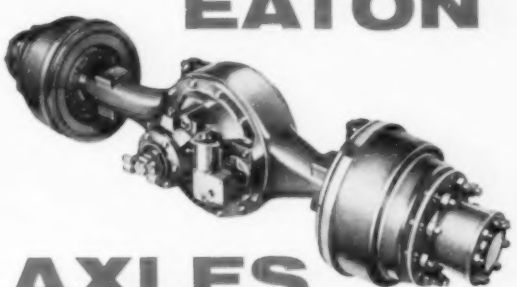
Replacement Ring-Gear
Not Made by Eaton

Only Genuine Eaton Axle Service Parts are Identical to the Original Production Components

Even Eaton Axle parts may wear out and require replacement. When this happens it is important that repairs be made with Genuine Eaton Axle Service Parts. They are identical to the original production components in design, metallurgy, heat treatment, and quality of finish—made to run together with the other axle parts. Eaton replacement parts are held to the rigid quality standards established for axle components and will deliver the same dependable, low-cost kind of service. So when, after thousands of miles of trouble-free operation, it may become necessary to replace worn parts in an Eaton Axle, it's most economical to make these replacements with Genuine Eaton Axle Service Parts.

MORE THAN TWO MILLION

EATON



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SERVICISED

JOINT FILLERS

for Concrete Paving

Three widely used Servicised Premolded Joint Fillers are briefly described below. Complete details, specifications and samples of any particular type or types are available on request.

KORK-PAK®

An exclusive Servicised development KORK-PAK consists of asphalt and granulated cork formed between two sheets of asphalt saturated paper.

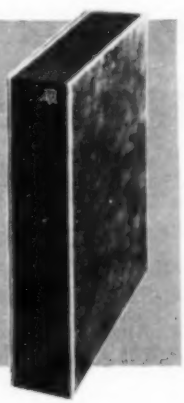
advantages

1. It is non-extruding
2. Recovers more than 80% of original thickness after compression
3. Low moisture absorption
4. Readily handled without breakage
5. Least expensive non-extruding type

recommended uses A general purpose joint filler, particularly for highway work where the top of the joint can be thoroughly sealed with Para-Plastic.

ASPHALT

A composition of asphalt, vegetable fibre and a small percentage of finely divided mineral filler, formed between two sheets of asphalt saturated paper.



advantages

1. Forms an easily compressible cushion
2. Is highly waterproof
3. Low in cost

recommended uses For interior concrete floor construction where black color is not objectionable, and most extensively in the formation of contraction joints in concrete construction where a ¼" or ⅜" thickness is often used.

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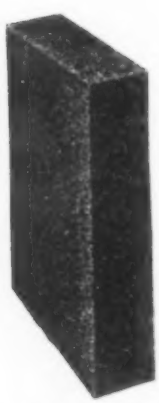

Cane Fiber Joint Filler is a non-extruding, resilient bituminous material consisting of cellular cane fibers securely bound together and uniformly saturated with a suitable bituminous binder.

advantages

1. It is non-extruding
2. Ordinary carpenter saw can be used for cutting
3. Lowest cost non-extruding type
4. Recovers more than 70% of original thickness after compression

recommended uses

An all-purpose joint filler extensively used for highway work where the upper portion of the joint can be thoroughly sealed with Para-Plastic Bituminous Rubber sealing compound. The complete line of Servicised Joint Fillers is described in the Servicised Catalog. Write for your copy.

SERVICISED PRODUCTS

CORPORATION

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Highway Lighting

New Lighting Scheme to Be Tested on Turnpike

A new fluorescent highway lighting system designed to improve driving flexibility during periods of adverse weather conditions, which features fixtures only 33 in. above the ground, has been installed on the New Jersey Turnpike for test purposes according to Sylvania Electric Products Inc. The test installation includes fifty 8-ft. fixtures along a 500-ft. strip of the turnpike opposite the Newark Airport.

These fixtures use the new Sylvania VHO (very high output) fluorescent lamps which provide 2½ times the light output of comparable single pin lamps, as reported by O. Howard Biggs, Sylvania vice president. "Characteristics of the VHO lamp," Mr. Biggs added, "make possible the design of a fixture using the new principles of 'controlled fluorescence' which result in a sheet of light confined less than 3 ft. above the road surface."

● This unique means of illumination has been developed to reduce the amount of light that can shine in a driver's eyes, and to cut the veiling fog brightness that normally interferes with vision during periods of fog.

"The design of Sylvania's system Mr. Biggs pointed out, is consistent with a study by the Illuminating Engineering Research Institute, which found that light coming from a direction perpendicular to the driver's line of sight would be superior in foggy conditions to headlights or standard street lighting arrangement."

Large Lighting Contract For Illinois Toll Road

A contract involving $1,834,500 has been awarded to Meade Electric Company of Chicago to install lighting on the Cook County portion of the Illinois toll road.

Additional lighting contracts also awarded include the following: G. A. Rafel Company, Chicago, $386,888; Premier Electrical Corporation, Chicago, $266,200; B and F Hi-Line Construction Corporation, Rockford, Illinois, $128,040.

(Continued on page 46)

New kind of rubber builds new cut-resistance, longer wear into every off-the-highway tire!

Tires built with Firestone Rubber-X defy slugging impacts and ax-edged snags to lower equipment downtime as no other tire material can. Combined with Firestone S/F (Shock-Fortified) Nylon, Firestone Rubber-X literally armors tires against costly impact damage. Built into a special tread design, this new rubber delivers new pull power for the worst bed or road conditions. You'll find Firestone Rubber-X off-the-highway tires outwork and outwear any other tires made! Ask your Firestone Tire Expert about these *tubed* or *tubeless* off-the-highway tires made with Firestone S/F (Shock-Fortified) Nylon and Firestone Rubber-X. *They're available at no extra cost.*

Firestone

BETTER RUBBER FROM START TO FINISH

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RIB EXCAVATOR® ROCK GRIP EXCAVATOR® ALL TRACTION® LOGGER

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Hauling through hub-deep mud or spreading sub-base to specs...

Paywagon® fleet delivers 90% working every shift on Illinois

A fleet of six International 75 Paywagons is making performance history—spearheading 5.4 miles of Illinois Toll Road construction, and relocating four miles of creek channel for CKG Associates,* on ex-marshland skirting Western Springs, Illinois.

Taking the mauling abuse of highballing 15-yard loads over rutted haul roads, chuck-holes, and grades, the Paywagon fleet is setting an amazing 90% "availability" record—through month after rugged month of 10-hour-shift days!

"Paywagon availability has been over 90% on this job," reports William P. Cagney, Jr., president, Contracting Material Co.

Battling over muck and gumbo fill that would mire low-slung rigs to a belly-dragging stall, the Paywagons give competitive bottom-dumps on the job a real lesson in traction, maneuverability, and clearance!

In addition, CKG Associates are using the cost-cutting controlled dumping Paywagon feature—another big International exclusive—to lay sub-base wholesale with dump-truck accuracy!

Try 75 Paywagon soft-fill beating traction and clearance—compare its load-speeding turbo-charged diesel hp! Measure advantages like planetary final drives. See how Hydro-Steer, selective and dual-wheel braking add operating ease and safety. Try controlled dumping accuracy. See your International Construction Equipment distributor for a demonstration.

*CKG Associates is composed of Contracting Material Co., Kenny Construction Co., and Louis Garavaglia. I. C. "Red" Harbour is Project Manager on the CKG job.

Four Paywagons of the six-unit fleet keep busy hauling from creek channel excavation. "Not a single Paywagon unit has lost a whole working shift all winter for downtime reasons," states Grading Supt. Ted M. Sliger.

International® Construction Equipment

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

Here comes a 75 Paywagon with a 15 cu yd load hauling in typical gumbo conditions. "These 2-axle units will pull through the soft fills much better than any others we've used," states William P. Cagney, Jr., President, Contracting Material Co.

availability toll road!

Paywagon speed and "off-road" mobility enable the contractor to keep ahead of schedule on sub-base spreading with only two "75" units! The toll road will accommodate six 12' traffic lanes. The contract involves building 16 traffic interchange structures!

. . . for more details circle 287 on enclosed return postal card

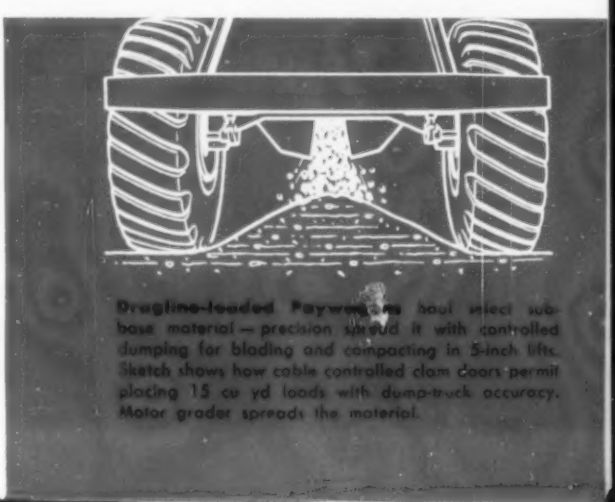
How Paywagon controlled dumping lays sub-base to engineer's specs!

Paywagon design provides simple, one-cable door control. An ingenious cable sheave arrangement, plus geared-together clam-action door design gives a simple, trouble-free Paywagon dumping mechanism.

This positive door-opening control permits the operator to windrow material accurately, or spot his full load exactly where desired.

High Paywagon clearance of 41 inches gives ample room to straddle dumped loads. The clam doors open out and up—leaving no dangling projections to foul up in windrows or fills.

Only the International Paywagon gives you this positive controlled dumping.



Dragline-loaded Paywagons haul select sub-base material — precision spread it with controlled dumping for blading and compacting in 5-inch lifts. Sketch shows how cable controlled clam doors permit placing 15 cu yd loads with dump-truck accuracy. Motor grader spreads the material.

BRAND NEW Barricade Flash!

the Big Beam TRANSISTA FLASH

- **Transistor type, heavy duty for long, dependable life.**
- **No moving parts to get out of order.**
- **Two-directional head or 360° dome type Fresnel.**
- **Electronic flashing mechanism weatherproofed. Telescoping top and rubber gasket make battery case completely weatherproof.**
- **Acid-proof plastic liners prevent interior case corrosion.**

TRANSISTA FLASH produces approximately 2000 hours of continuous flashing from two standard 6-volt batteries, available anywhere. Provided with a concealed, tamper-proof switch operated from outside of case. Equipped with bracket for attaching to barricade. Lens or Fresnel supplied in either amber or red plastic—specify color. Flash frequency is approximately 72 times per minute. Lamp is finished in yellow baked enamel.

Model 410T

Model 418T—with dome type Fresnel.

Model 417T—7 inch head. Otherwise, same as Model 410T.

No. 433 Barricade—All metal, strong, stable on any surface. Has angle iron construction, closed ends.

Big Beam—makers of explosion-proof lamps, emergency lights, hand lamps and flares. 8393

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Personals

Louis Garavaglia, Jr.

Jule and Louis Garavaglia Killed in Helicopter Crash

On March 24 Louis Garavaglia, Jr., 40, and his brother Jule, 28, died in an exploding helicopter. Their contracting firm, with offices in Detroit, is probably the largest of its type in Michigan. It has over $15 million in current contracts and expects to do about $50 million this year.

The brothers were joint contractors on substantial work on the Illinois Toll Road now in progress. The firm recently completed the largest bridge to be built in Michigan using prestressed concrete beams and is now sinking a caisson in Waterworks Park, building a

Jule Garavaglia

(Continued on page 32)

The All NEW Clipper®

"SAILS RIGHT THRU"

36 H.P. SELF-PROPELLED CONCRETE SAW

MODEL C-362
36 H.P.
Other Models
Gasoline or Electric
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- DUAL BALANCE DESIGN
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- POSITIVE BALL BEARING SCREW FEED
- 6 STEEL-CABLE-REINFORCED V-BELTS

USE THIS HIGH PRODUCTION CONCRETE SAW FOR FASTER CUTTING WITH LONGER BLADE LIFE

OVER 36 OUTSTANDING FEATURES FOUND ON NO OTHER SAW!

DUAL BALANCE DESIGN – Precision weight distribution for (1) Easy Maneuverability . . . one man lifts-up, lines-up, then saws, (2) Constant adequate weight over the blade during cutting. Only Clipper has it!

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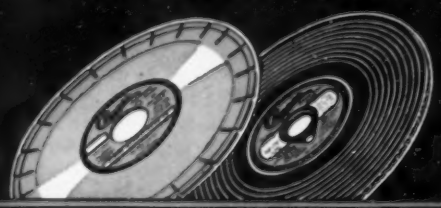
POSITIVE BALL BEARING SCREW FEED – Assures accurate cutting depth control. A MUST for abrasive blades.

6 STEEL-CABLE-REINFORCED V-BELTS – Delivers full 100% power to the blade for best economy and performance.

RUGGEDLY BUILT TO GIVE YEARS OF TROUBLE FREE SAWING!



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THE CLIPPER MANUFACTURING COMPANY
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432X Offices in Principal Cities Coast to Coast; Factories in England, France, Germany, Italy

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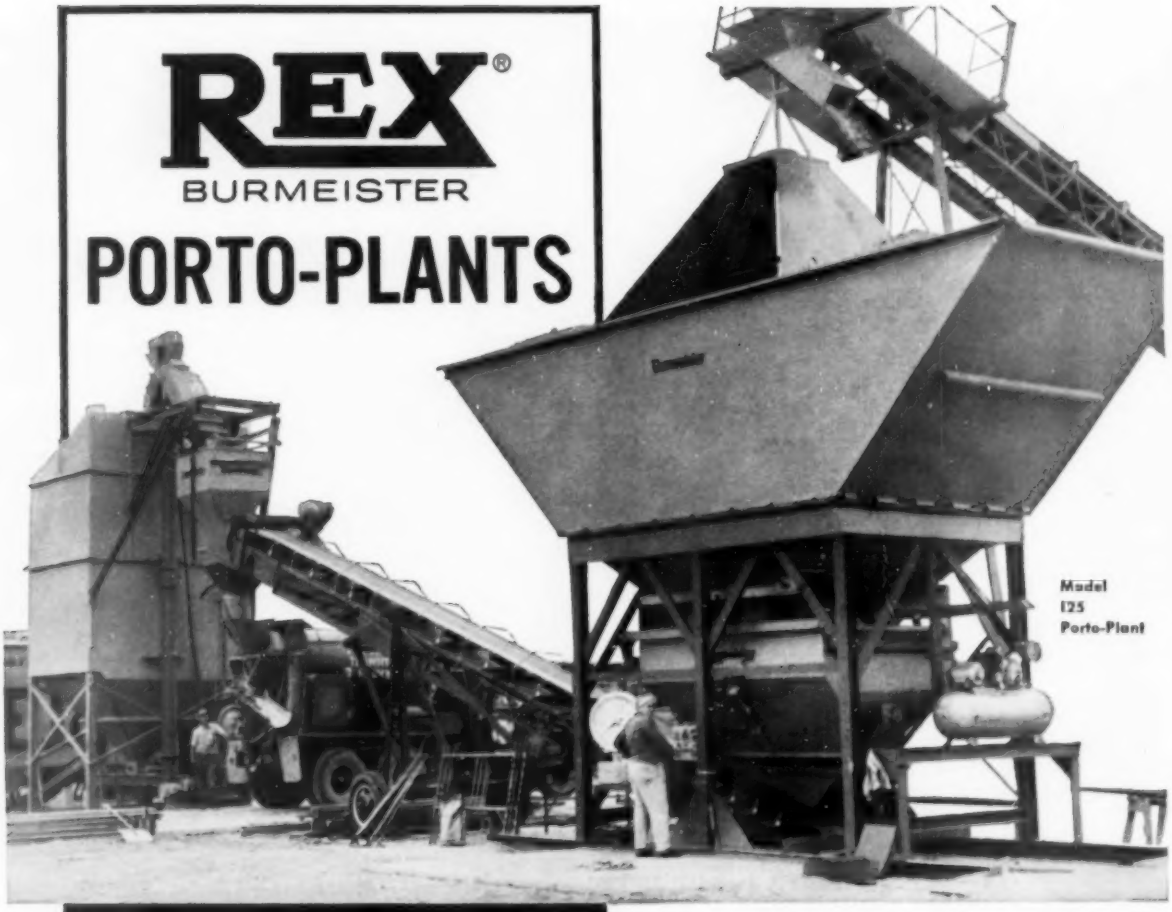
REX®
BURMEISTER
PORTO-PLANTS



Model
125
Porto-Plant

BIGGEST CAPACITY per dollar invested

That's it with a Rex! *Value*—the best. *Capacity*—the biggest. Actually, the Porto-Plant will do everything a permanent plant will—with all the money-saving advantages of easy portability, fast erection.

For decentralized or "main-yard" setups, the Porto-Plant benefits to you are the same: high output, an easy 125-yd.-per-hour production; one-man, low-cost operation; accurate batching to the tightest specs; famed Rex Burmeister quality of design and workmanship. Get all the facts on the Model 125 Porto-Plant today. Write CHAIN Belt Company, Burmeister Division, 4652 West Greenfield Avenue, Milwaukee 1, Wisconsin.

No. 1 in sales across the country...here's why!

- Highest capacity of the portable batchers!
- Greatest portability—three easily moved, fast-setup components.
- Ready to go—just plug in services!
- Matches batches to most rigid specs.
- Push-button operation.
- No cement on belt conveyors.
- No excavation required.
- Complete—nothing else to buy!
- Unquestionably the best buy in the entire batcher field.

CONSTRUCTION REX MACHINERY®

PORTABLE BATCHING PLANTS • CENTRAL MIX PLANTS • COMBINATION PLANTS • TILT-UP MIXERS

CHAIN BELT COMPANY

ADJUSTA-WATE • HORIZONTAL • ADJUSTA-HITE MOTO-MIXERS

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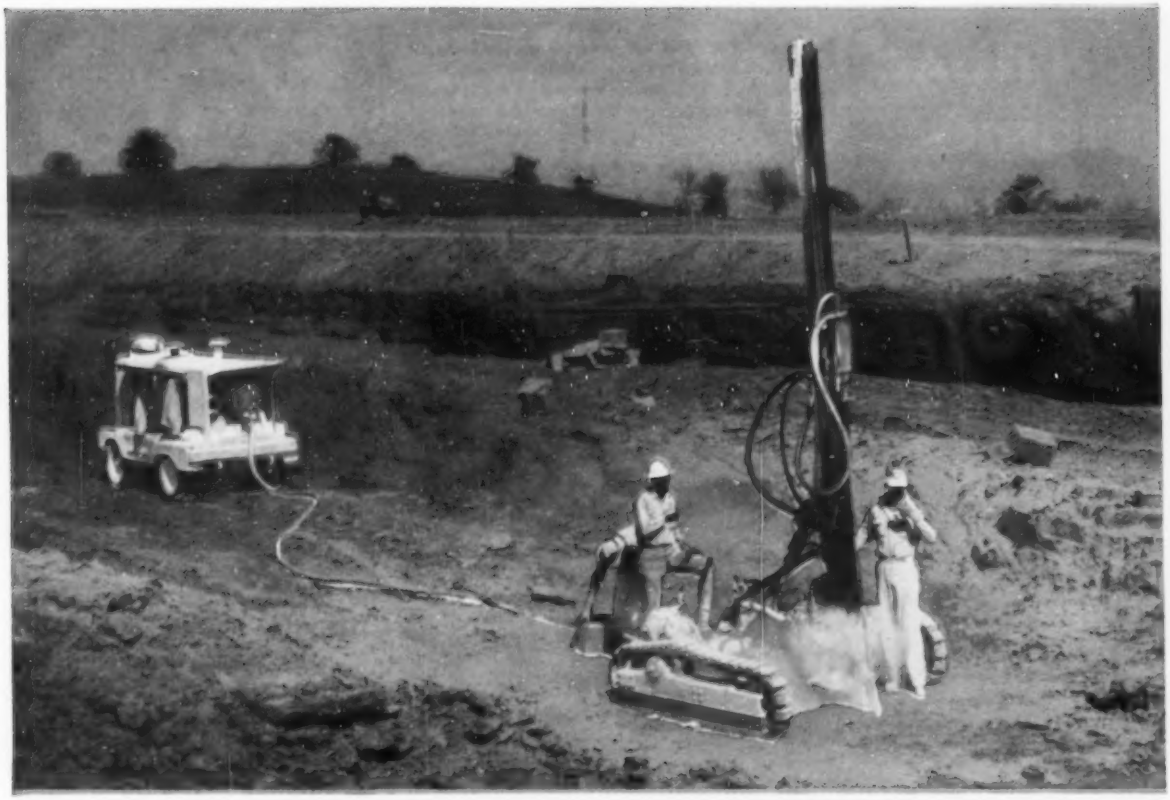

Carve rock into road...faster
Choose Gardner-Denver Drills and Portables

Get rock out of the way . . . keep contracts on schedule—with a Gardner-Denver rock drilling team.

"Air Trac"®—self-propelled for quick, accurate spotting of vertical, horizontal or angle holes . . . available with 4" or 4½" rock drills.

Rotary 600—Water-oil cooling system . . . clutch for cold-weather starting . . . easy-to-get-at parts to simplify field maintenance.

Other Gardner-Denver air-powered equipment for the contractor includes:

Fast-drilling sinkers

Hard-hitting sheeting drivers

Handy air hoists

Easy-handling concrete vibrators

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

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ON ROAD WORK–

Tamping fill around 4 ft. concrete pipe culvert on New York State Thruway Extension near West Seneca, N.Y. The Barco Rammers are owned by S. J. Groves & Sons Co., Syracuse, N.Y.
(Photo: CONSTRUCTIONEER)

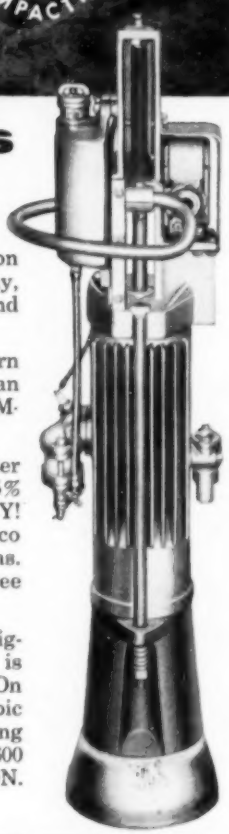
Barco Rammers are Essential!

CHECK THE RECORDS for *soil compaction* on every top ranking highway, toll road, thruway, or freeway built in recent years and you will find Barco Rammers!

The key to better construction—No modern trend has had a more phenomenal growth than the specification of HIGH DEGREE SOIL COMPACTION for all kinds of projects.

Easily meet rigid specifications—In test after test, Barco Rammers have delivered 95% to 97.5% compaction (modified Proctor Method)—EASILY! EFFICIENTLY! ECONOMICALLY! The Barco Rammer is especially useful in restricted areas. ONLY Barco can produce specified high degree compaction on lifts up to 20 inches.

Get jobs finished on time—One of the biggest advantages offered by Barco Rammers is ability to handle work in minimum time. On area tamping, one man can average 20 to 30 cubic yards of fill per hour. On trench backfill, using lifts up to 24", the rate for 18" trench is 360 to 600 feet per hour. ASK FOR A DEMONSTRATION.



FOUNDED 1908
BARCO
PRODUCTS BACKED BY EXPERIENCE

BARCO MANUFACTURING CO.
5156 Hough Street • Barrington, Illinois

BARCO RAMMER *for High Degree Soil Compaction*
BARCO VIBRA-TAMP *for Granular Fill and Bituminous Surfacing*

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Personals

(Continued from page 28)

bascule bridge in Saginaw, working on a five-mile tunneling job for the Wayne County Road Commission for the new water intake in the Detroit River off Fighting Island, among other projects. It has done work for the Michigan State Highway Department since 1930.

Louis was a member of the board of directors and past president of the Michigan Road Builders' Association and was a member of the board of the Upper Peninsula Concrete Pipe Company, the Beverly Development Company, and the Mackinac Aggregates Company.

Brodrick of Kansas Dies

Lynn R. Brodrick, director of the Kansas Highway Commission, died recently, bringing to a close a career of good roads boosting which extended over thirty-five years. He served at various times as a Commission member or on highway committees on the state projects, and was only recently given an award for distinguished service to highways by a Kansas contractor group.

MAURICE MARTIN, administrative assistant to the director, has been appointed acting director of highway by governor George Docking.

MORRIS GOODKIND of the New Jersey state highway department has been named the 1958 recipient of the Egleston Medal by the Alumni Association of Columbia University Engineering School. This medal is given for "distinguished engineering achievement". Mr. Goodkind graduated from the school in 1910.

CHARLES H. BOOTH, JR., is elected President for 1958 of The Constructors Association of Western Pennsylvania. His company is Booth & Flinn Company, of Pittsburgh, Penna.

O. L. KIPP, "Mr. Highways" in Minnesota, died recently at age 73. Before his retirement, he was assistant commissioner and chief engineer of the Minnesota highway department, as the culmination of a life-long career in highways.

you can't beat a ROLL-O-MATIC

—for meeting the most rigid specifications on compaction and smoothness of finish surface.

Write for literature.

THE GALION IRON WORKS & MFG. CO.
General and Export Offices, Galion, O., U.S.A.

GALION
ESTABLISHED 1907

MOTOR GRADERS & ROLLERS

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R. G. LeTourneau

LeTourneau and Kiddoo Receive "Beaver" Awards

The coveted "Beaver Award" was presented to two well-known construction leaders at the third annual awards dinner of The Beavers, held recently in Los Angeles.

Robert G. LeTourneau, pioneer earth-moving personality, received the award, along with Guy C. Kiddoo, general vice-president of the First National Bank of Chicago, often known as the "contractors' banker."

EDWARD BRAUSE has been advanced to vice president, public relations, Merritt-Chapman & Scott Corporation, New York City. He has been director of public relations for the past eight years, and will continue with his expanded activities under Robert E. Harvey, senior executive vice president.

FRED J. GRUMM, who retired in 1950 as deputy state highway engineer of California, died at his home in Sacramento at age 72.

Grumm was a long-time career man in the department, having joined it in 1922, and holding various engineering positions. He was the leader in the campaign to secure passage by the California legislature of the freeway act of 1939, which recognized the advantages of controlled access.

More recently, he was active in civic affairs in Sacramento, and at the time of his death, was chairman of the Sacramento Redevelopment Agency.

JOHN J. LESLIE, St. Louis county highway engineer, is 1958 president of the Highway Engineers' Association of Missouri.

California Cost Index Takes Another Drop

The construction cost index of the California Division of Highways dropped 7.7 per cent in the first quarter of 1958, sompared with the previous quarter. It stood at 241.8 (1940 equals 100) at the end of the first quarter. Compared with the first quarter of 1957, the index was down 12.9 per cent.

This drop is credited to keen competition among bidders for jobs. An average of 9.3 bidders per project was reported for the first quarter.

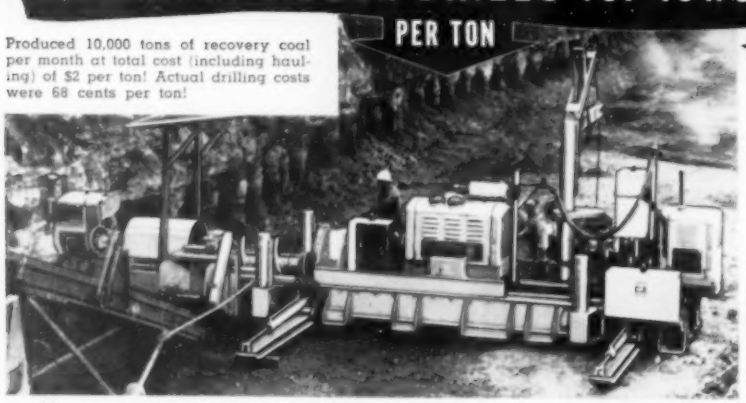
Big Earth Moving Yardage in Michigan Program

Over 35 million cubic yards of earth and rock (largely earth) will be moved by contractors during 1958 in the Michigan state highway program. The prices of this item in state roadwork for 1957 averaged $.32, having fluctuated narrowly between $.28 and $.32 since 1949.

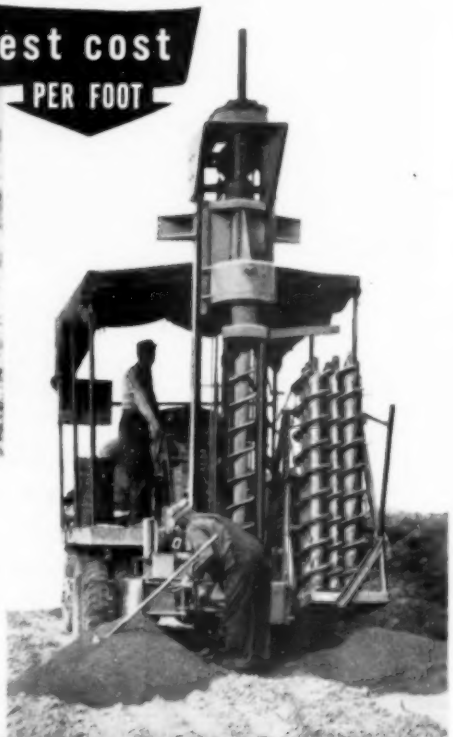
Expressway excavation yardage in the program is expected to average 250,000 cubic yards per mile for prevailing rolling or flat prairie terrain.

McCARTHY AUGER DRILLS for lowest cost PER TON PER FOOT

Produced 10,000 tons of recovery coal per month at total cost (including hauling) of $2 per ton! Actual drilling costs were 68 cents per ton!



Powerful McCarthy drills help cut costs everywhere. The newest coal recovery units have finger-tip control of auger rotation and horizontal feed of drill. Operators have produced recovery coal for as little as $2 per ton, including make-ready, operation, maintenance, depreciation and hauling . . . actual drilling cost 68 cents per ton. The McCarthy is self-moving, all hydraulic and requires just two operators. Conveyor can work from either side. Choose from twelve models. Bulletins M-101 and M-102 give complete information. Write for them now.



Model 106-24. World's fastest. Augers deeper, larger holes than any other. Speed reducer slows rotation for hard rock holes. Drills 8" and 9" dia. holes in shale and sandstone. Up to 24" in softer formations.

Manufacturer of Drilling Equipment Since 1901

THE SALEM TOOL CO.
S. ELLSWORTH AVE. SALEM, OHIO, U.S.A.

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Built tougher . . . stronger with NYGEN®

THE NEW WIDE BASE GENERAL

L LOGGING
C CONSTRUCTION
M MINING

- built with exclusive NYGEN cord for matchless strength
- designed to provide crawler-like flotation and traction
- minimum rolling resistance in all kinds of going
- precision engineered to reduce operating costs

You'll get every job done faster and for less when you equip your units with the all-new wide-base General LCM tire. Built with General's exclusive stronger-than-steel Nygen cord, the LCM rolls over even the toughest job hazards . . . provides greater traction and flotation than ever before. Find out now how this big wide-base General LCM with Nygen can boost your job profits!

Specify Generals on your new equipment

THE GENERAL TIRE & RUBBER COMPANY • Akron, Ohio

THE GENERAL TRUCK TIRE

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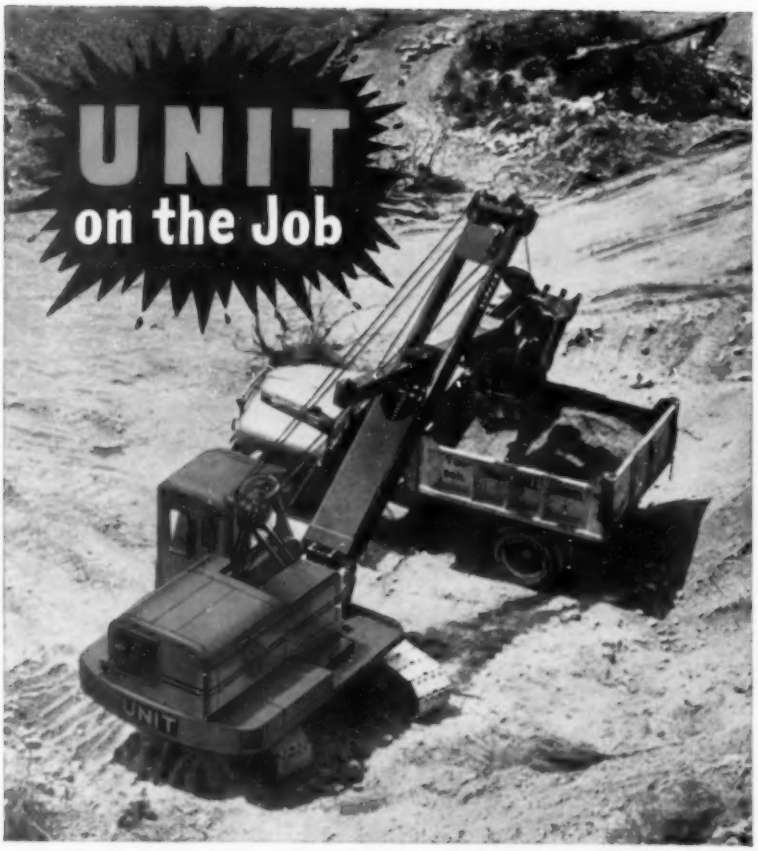


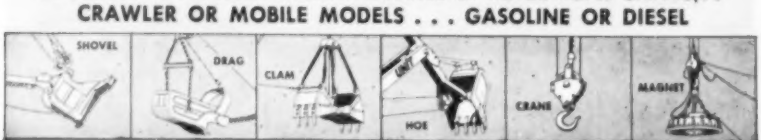
SWING SPEED makes PAY LOADS!

Here's a UNIT ½ Yard Shovel doing a PRODUCTION DIGGING JOB in a gravel pit. UNIT owners like the ease of operation and the FULL VISION CAB for complete visibility. They also like the sturdy construction and the many mechanical features, plus the ECONOMICAL PERFORMANCE and LOW UP-KEEP which all add up to EARNING POWER. Why not investigate what UNIT can do for you — on YOUR next excavating and material handling job?

SEE FOR YOURSELF: *Let us send you our novel TV Brochure. It illustrates the complete UNIT line.*

UNIT CRANE & SHOVEL CORPORATION
6407 WEST BURNHAM STREET • MILWAUKEE 14, WISCONSIN, U. S. A.

½ or ¾ YARD EXCAVATORS...CRANES UP TO 20 TONS CAPACITY
CRAWLER OR MOBILE MODELS . . . GASOLINE OR DIESEL



All Models Convertible to ALL Attachments!

A 7147-2/3-PC

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New Publications

Cement and Concrete

Special Technical Publication No. 205; 158 pages; hard cover, 6 x 9", $4.00. American Society for Testing Materials, 1916 Race Street, Philadelphia, Pa.

The papers in this volume include advanced thinking on topics not commonly covered in technical sessions, as for example the paper on Hydrophobic Cement. However, basic problems commonly associated with this material are also adequately covered.

Eight papers are included. The reader will find the volume well illustrated and documented with tables of data. Some extensive bibliographies are also included. The papers originally presented during the second Pacific Area National Meeting in Los Angeles, September, 1956, under the auspices of Committee C-1 on cement and Committee C-9 on concrete and concrete aggregates. The volume contains late discussions of papers.

FIELD STUDIES OF METHODS AND MATERIALS FOR JOINT AND CRACK SEALING. Bulletin 166, Highway Research Board, 2101 Constitution Avenue, Washington, D. C. Price $0.80.

Contains two papers presented at the 36th Annual Meeting of the Board, January, 1955, by L. A. Fickes and C. C. Rhodes; and by E. Tons and Vincent J. Roggeveen.

HIGH CAPACITY STUDIES. Bulletin 167, Highway Research Board, 2101 Constitution Avenue, Washington, D. C. Price $1.60.

This bulletin contains six papers sponsored by the HRB Committee on highway capacity, presented at the 36th annual meeting of the board in January, 1957.

POLICIES of the American Automobile Association, 1712 G Street N.W., Washington, D. C. New edition. Statement of the Associations' position on highways and taxation of motorists; on traffic and safety; and related problems. This 38-page brochure of interest to highway administrators, traffic engineering agencies and others.

(Continued on page 41)

Look ahead...*move ahead*...and stay ahead

with Allis-Chalmers construction machinery

fastest growing acceptance in the business...

Everywhere you go, you see more and more Allis-Chalmers construction machines—because they're *doing more*. On big jobs or utility work, they're proving value by performance . . . earning steadily increasing popularity.

HERE'S THE COMPLETE LINE

Allis-Chalmers crawler tractors for every application

53 draft hp to 325 net engine hp
12,200 lb to 45,500 lb bare wt.
. . . plus a complete line of matched bulldozers, side booms, mounted rippers, other attachments.

HD-21
225 net engine hp
torque converter drive
56,260 lb (approx. as shown)

HD-21A illustrated—
Two other models available

4-CU-YD
HD-21G
225 net engine hp
13-ft., 4-in. dump height
66,500 lb

3-CU-YD
HD-16G
150 net engine hp
12-ft., 3-in. dump height
47,800 lb

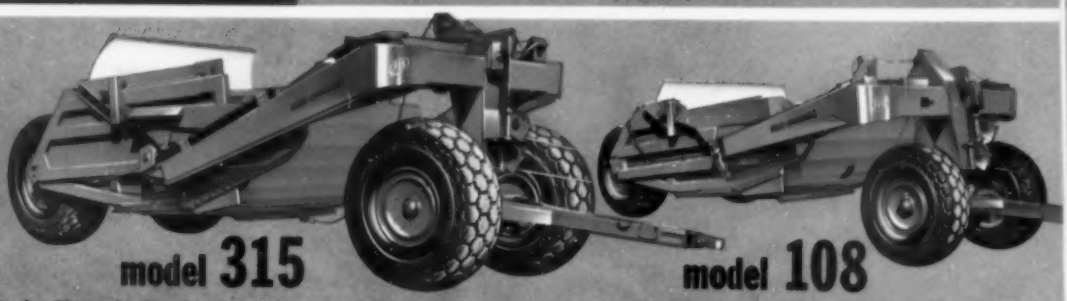
Designed and built for high-volume

Allis-Chalmers motor scrapers and wagons

Five models that offer major advantages on big jobs or utility work.

TS-360
280 hp
Struck—15 yd • Heaped—20 yd
Weight—49,050 lb (approx.)

TW-360
280 hp • 28 payload tons
Struck—17 yd • Heaped—24 yd
Weight—47,000 lb (approx.)



model 315
Struck—15 yd • Heaped—20 yd • Cable control • 25,850 lb

model 108
Struck—8.4 yd • Heaped—12 yd
Cable control • 15,250 lb

HD-16 Choice of two outstanding drives: torque converter 150 net engine hp | all-gear 141 belt hp. 39,000 lb (approx. as shown)

HD-11 94 belt hp. 25,900 lb (approx. as shown)

HD-6 63 belt hp. 16,470 lb (approx. as shown)

HD-16DC illustrated—Five other models available

HD-11B illustrated—Two other models available

HD-6E illustrated—Three other models available

2¼-CU-YD HD-11G 111 net engine hp. 11-ft., 7-in. dump height. 32,000 lb

1½-CU-YD HD-6G 72 net engine hp. 10-ft. dump height. 19,600 lb

Allis-Chalmers tractor shovels in a full range of bucket sizes

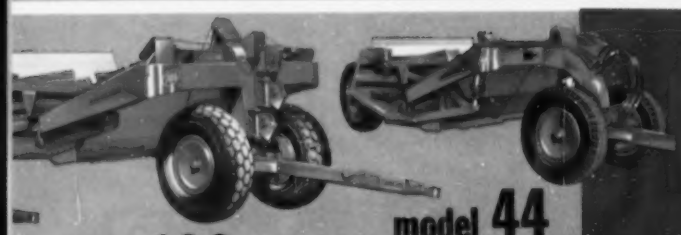
Up to 7-cu-yd capacity to match requirements for various materials and job conditions.

performance you can depend on

TR-260
200 hp • 18 payload tons
Struck—11 yd • Heaped—15 yd
Weight—43,800 lb (approx.)

TS-260
200 hp
Struck—11 yd • Heaped—14 yd
Weight—39,600 lb (approx.)

TS-160
155 hp
Struck—7 yd • Heaped—9½ yd
Weight—28,500 lb (approx.)



model 106
Struck—6.1 yd • Heaped—8.5 yd
Cable control • 10,300 lb

model 44
Struck—4 yd
Heaped—5.4 yd
Hydraulic control
6,595 lb

Allis-Chalmers pull-type scrapers

The only line with low bowl, high apron lift, forced ejection in every size.

SEE MORE ENGINEERING IN ACTION

Allis-Chalmers motor graders—designed for comfort-conscious operators and cost-conscious owners

Model D Special

50 brake hp
10,900 lb (gasoline)
11,450 lb (diesel)
4 forward speeds to 25 mph (approx.)
1 reverse speed to 3 mph (approx.)
All-steel cab*
Shiftable moldboard*
Hydraulic scarifier*
Leaning front wheels*
Power circle turn*

**Also available individually with the Model D Standard as optional equipment.*

Rear-mounted attachments available as optional equipment include ⅜-yd loader; shoulder maintainer; windrow eliminator.

Model D Standard

50 brake hp
8,800 lb (gasoline)
9,350 lb (diesel)

FORTY-FIVE

120 brake hp
6 forward speeds to 20.6 mph
3 reverse speeds to 7.0 mph
23,800 lb (approx.)

Ask for a demonstration. Your Allis-Chalmers dealer will be glad to prove the value of any of these machines in a working demonstration. Call him now.

Look ahead...*move ahead*...and stay ahead

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

FORM MS-1302

Litho. in U.S.A.

New Publications

(Continued from page 36)

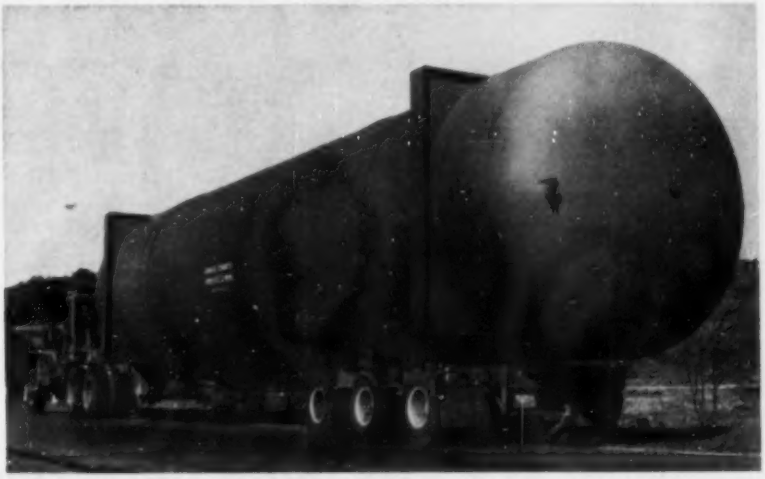
HIGHWAY TRANSPORTATION LEGISLATION IN 1957; part three, on uniform laws and motor vehicle legislation. A summary of federal and state activity; by the National Highway Users Conference. For copy, address the conference at National Press Building, Washington 4, D. C.

PUBLICATIONS OF THE HIGHWAY RESEARCH BOARD. A list of the titles of hundreds of technical references published by the Board, may be obtained by writing to the Board at 2101 Constitution Avenue, Washington, D. C.

FUNDAMENTAL AND PRACTICAL CONCEPTS OF SOIL FREEZING. Bulletin 168, Highway Research Board, 2101 Constitution Ave., Washington, D.C. Price $4.00.

The nine reports in Bulletin 168 add much to the published information, be it of a practical nature or theories and hypotheses concerning the fundamentals of the soil-water freezing phenomenon. Three papers deal with the practical aspects of the relative thermal conductivities of different soils and pavements as they influence soil temperatures; the ability of engineers to compute pavement temperatures from data contained in weather reports; and loss and recovery of bearing capacity of a wide range of soil types.

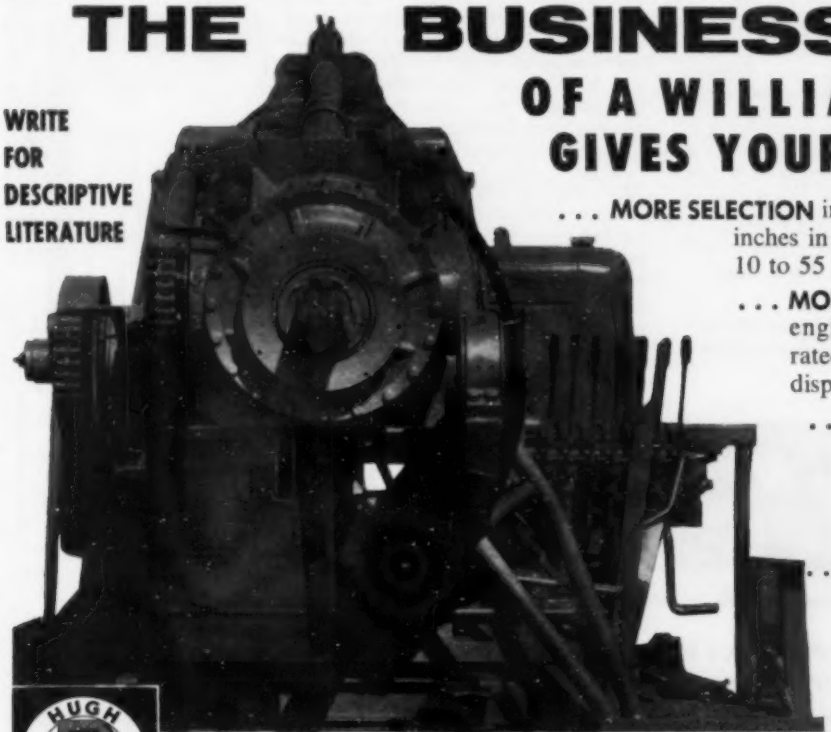
Is This a Tank or Truck?



This 30,000-gal. storage tank has a special rig in which the tank acts as its own truck bed. Manufactured by the Advanced Products Division of ACF, the rig has cables connecting the rear dolly and forward cradle on which the tank rests. Special permits are needed for highway transit. (United Press Photo).

THE BUSINESS END...
OF A WILLIAMS DIGGER GIVES YOUR BUSINESS...

WRITE FOR DESCRIPTIVE LITERATURE



. . . **MORE SELECTION** in hole sizes ranging from 8 to 96 inches in diameter with hole depths from 10 to 55 feet.

. . . **MORE POWER** by an appropriate engine furnished for each model rated from 226 to 500 cubic-inch displacement.

. . . **MORE FLEXIBILITY** when equipped with either Turntable or Wiggle-tail bases with extending, retracting and side-leveling features.

. . . **MORE AUGER CROWD** by additional downward pressure supplied by the digger engine or by a hydraulic crowd mechanism.

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HUGH B. WILLIAMS MFG. CO.
8330 Lovett Ave. • Dallas, Texas
Manufacturer

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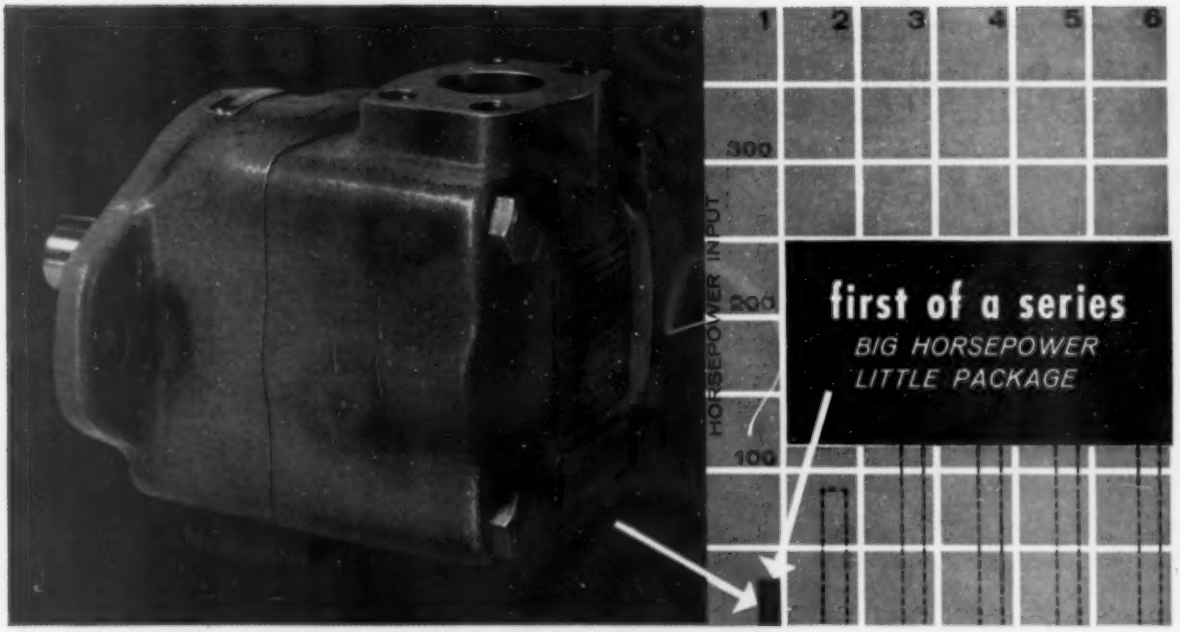


NEW VICKERS® high performance vane pump

• high speed • high pressure • high efficiency • high service life

NEW COMPACT DESIGN . . . more than twice the horsepower of previous pumps in the same package size.

NEW VANE CONSTRUCTION . . . positive vane tracking at all speeds assures efficient operation at increased speeds and pressures.

NEW SIZES not previously available . . . answers mobile equipment designers' need for greater hydraulic horsepower in limited space.

NEW PARTS INTERCHANGEABILITY . . . many common parts for single and double pumps (two pumps on the same shaft in one envelope). Lessens inventory requirements.

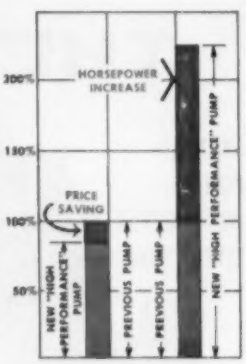
NEW 4-BOLT SAE FLANGE CONNECTIONS . . . will also accommodate user's 2-bolt flanges of the proper design.

NEW 2-BOLT MOUNTING (SAE 1959 STD.).

NEW REPLACEABLE PUMPING CARTRIDGE . . . all wearing parts of pump are incorporated in one replaceable cartridge. Easy field replacement without removing pump from its mount. Cartridges available in kit form.

MORE HORSEPOWER PER DOLLAR. The graph at the right makes a revealing comparison between this new pump and a previous pump of the same rated delivery. The new Vickers "High Performance" pump provides more than *twice the horsepower* at *less cost* while shrinking package size from 200 to 112 cubic inches.

The complete line of "High Performance" pumps (both single and double) is being readied for release. Size range will accommodate your largest requirements. This first model of the series is available in three ring capacities; 12 gpm, 14 gpm, and 17 gpm as shown in table below.



Model Number	Delivery-GPM 1200 RPM 100 PSI	Delivery-GPM 2000 RPM 2000 PSI	Input Horsepower @ 2000 RPM 2000 PSI	Package Size†	Weight
2V12A-**10	11.8	17.8	25.5	L. 5⅛" W. 4⅛" H. 5¼"	26 Lb.
2V14A-**10	13.6	20.4	29.0		
2V17A-**10	16.6	25.2	36.0		

†Exclusive of Shaft Extension and Mounting Lobes

8050

Write for new illustrated Bulletin No. M5108 for further details and performance characteristics.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION

Mobile Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1432 • Detroit 32, Michigan

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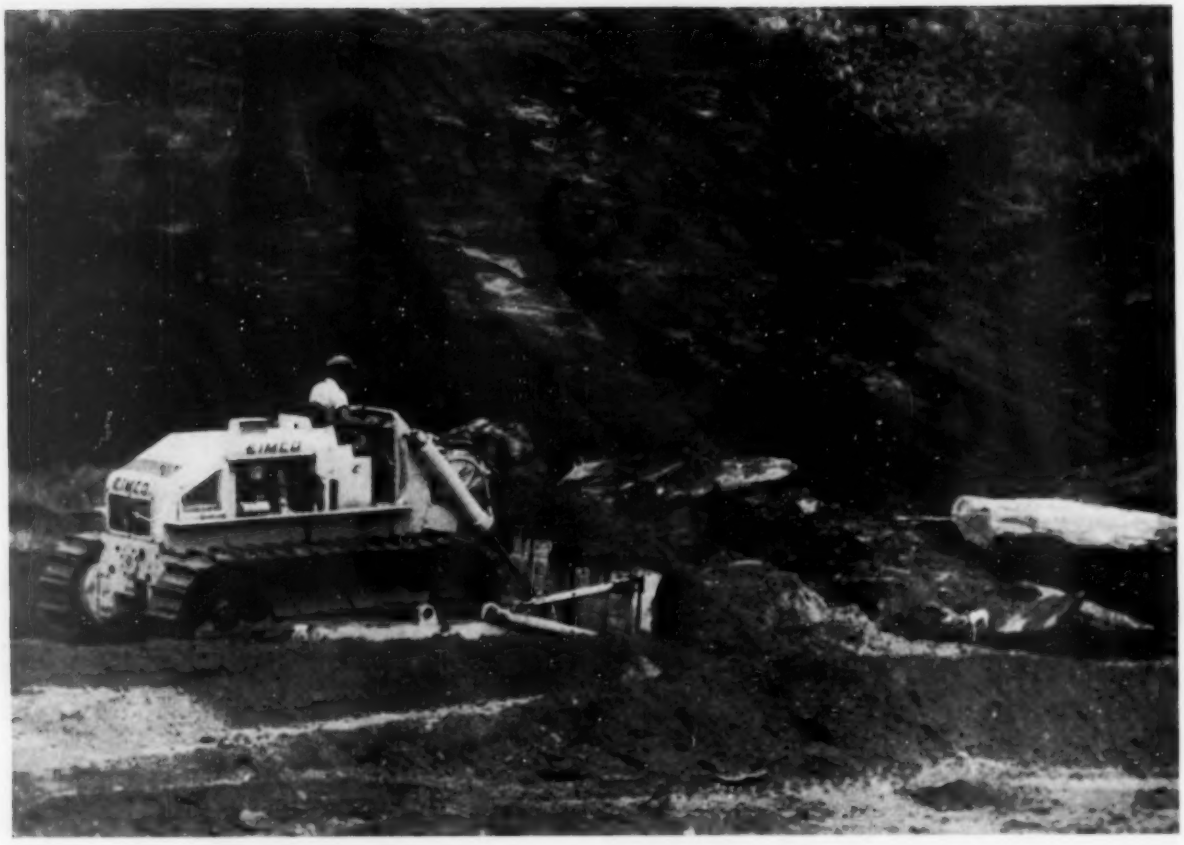

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The work site consisted of a steep incline with rock outcropping in big slabs. The bottom ends of the rocks were deeply embedded and required maximum tractor effort to remove them.

Bulldozing down the slopes, the torque converter drive of the 105 enabled it to pick up a capacity load and move down the slope ahead of the competitive tractors with their outmoded conventional type drives.

Throughout the test — straight bulldozing, removing rocks and maneuvering — the 105 managed everything that came its way and did it with the least amount of operator effort. In direct contrast, the competitive tractor operators were constantly clutching, changing gears and braking to accomplish their tasks.

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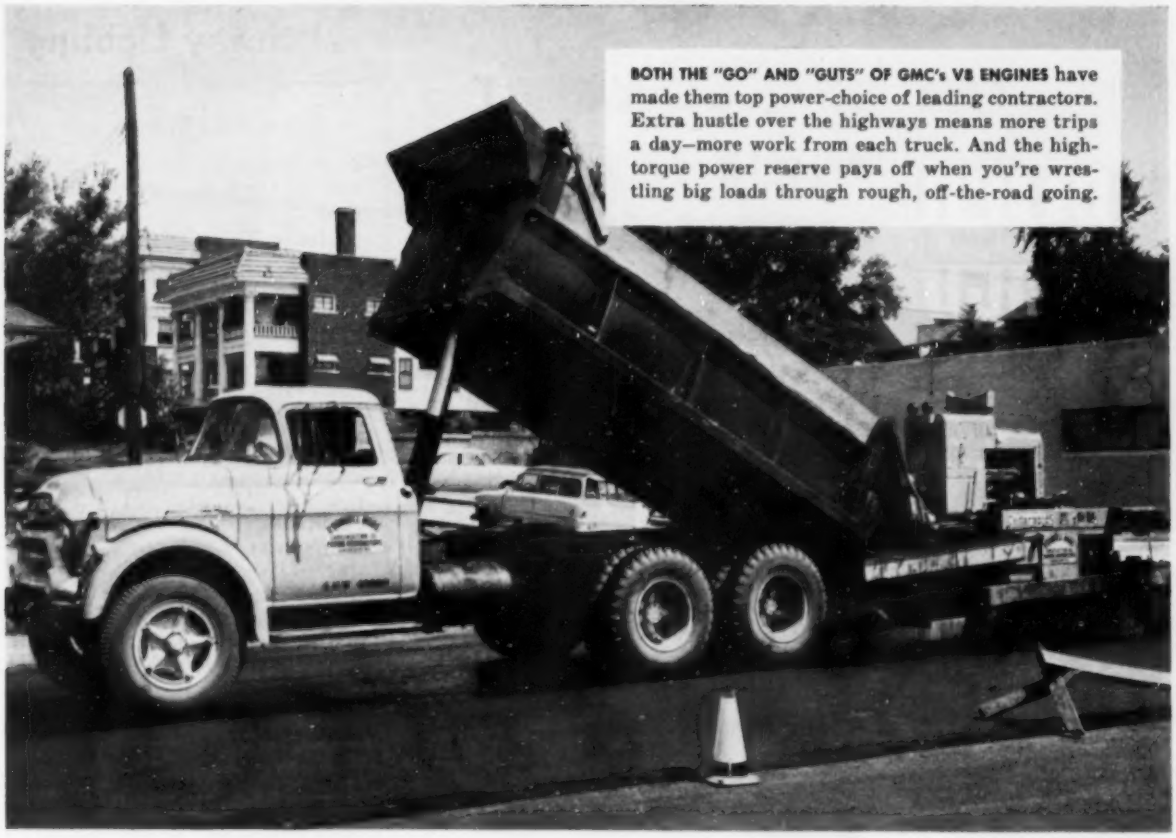

BOTH THE "GO" AND "GUTS" OF GMC's V8 ENGINES have made them top power-choice of leading contractors. Extra hustle over the highways means more trips a day—more work from each truck. And the high-torque power reserve pays off when you're wrestling big loads through rough, off-the-road going.

1000 tons in 8 hours with just 6 GMC's!

There's nothing like having nimble truck-power when you're squeezed for time on a job. And O'Donnell Brothers' GMC's really had to move when they tackled this Kansas City, Mo., paving operation.

For it took 1000 tons of asphalt. That had to be hauled 3 miles—most of it through city traffic. The job had to be completed within one 8-hour day. Yet they handled it with just 6 GMC dumps!

That's the pay-off on GMC's V8 truck-power. It comes from *truck-built* engines—high in horsepower and torque. So the trucks get away from the loading site *fast*—even with top-capacity loads. They lose no time on the highways. And, in city work with numerous stop lights, their quick pickup speeds up every run.

All-over GMC ruggedness is still another time-saver. For these husky haulers keep their peak efficiency. Failures are a real rarity. And there's far less time out for repairs.

That's the kind of performance you should expect to get from your truck, too. And you'll get it—if it's a GMC, made by the world's largest commercial vehicle manufacturer. See your GMC dealer!

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Highway Lighting

(Continued from page 24)

These contracts are for areas outside of Cook County on the toll road.

Efenge Electrical Supply Company was awarded a contract of $212,368 to supply lighting equipment, and Westinghouse Electrical Corporation, a contract for $73,999 for lighting control equipment.

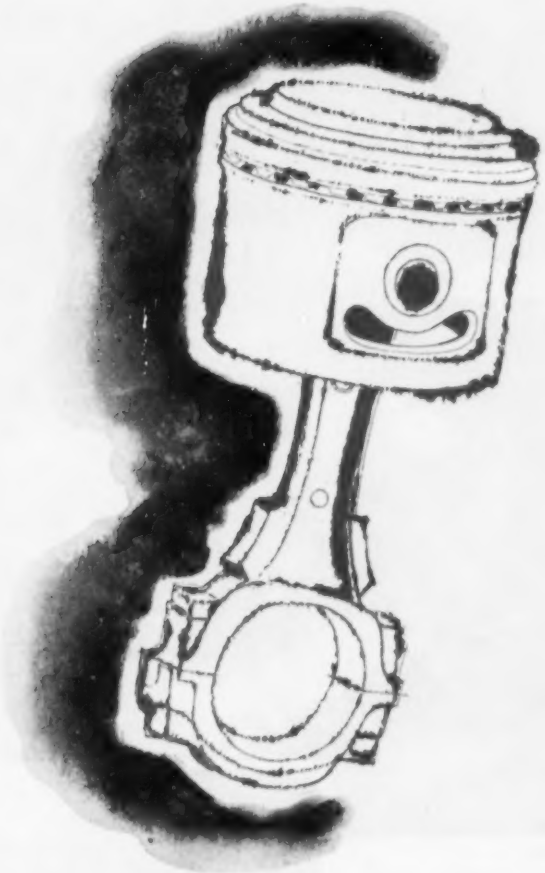
● This is part of a total of about $4 million in awards placed during April for lighting and signal installation, which came in for criticism by Chicago newspaper. The Meade award was made without competitive bids, being given to single bidder at a price 12% higher than the commission staff's estimate. Austin Wyman, Chairman of the Toll Road commission said that while there were competitive bids for installations outside of Cook County, the Commission felt it necessary to go ahead, despite receiving only a single bid for work within the County. Other contractors had focused their attention on work outside of the county.

The six lighting contracts, taken together, totalling $3,201,995, were actually $½ million below the combined estimates.

$100 Per Day Asked For Consultants

A maximum per diem rate of $100 for temporary consultants engaged by the federal government has been urged by the National Society of Professional Engineers in recommendations made to Congressional appropriations chairmen. Society spokesmen pointed out that the maximum current per diem rate of $75 is insufficient for the economically feasible performance of consulting engineering services due to the existing high overhead expenses.

The society's position is that "the federal government deserves and is entitled to the very best engineering talent obtainable." The net result of a federal limitation less than $100 per day, it was said, could "very well be that the most qualified engineering firms would refrain from undertaking government engineering projects."



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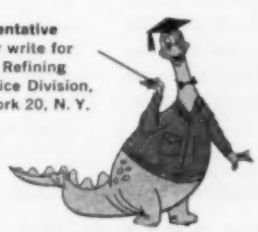

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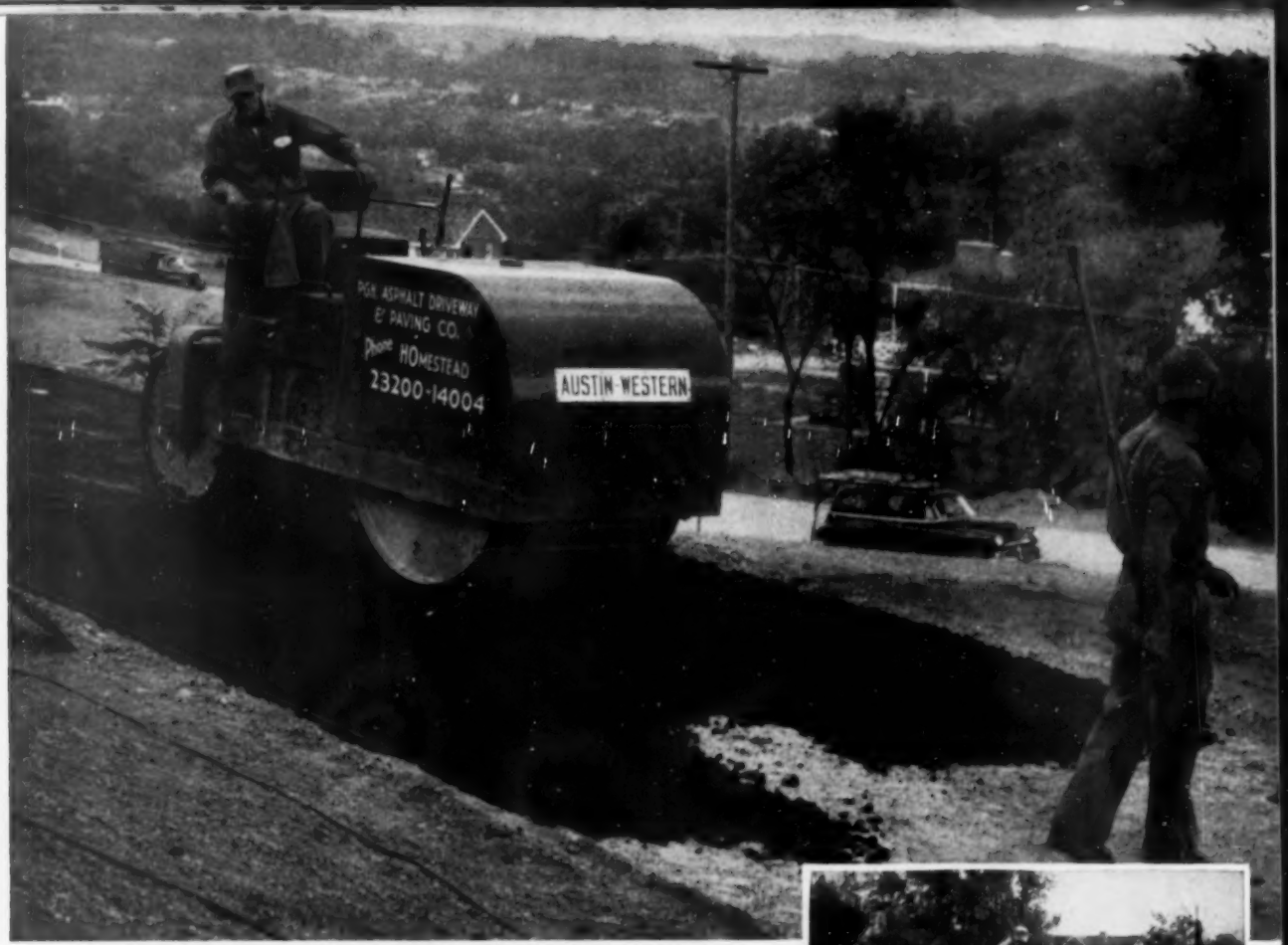

A-W portable tandem roller, owned by Pittsburgh Asphalt Driveway & Paving Co., rolling binder layer of asphalt.

"Our Austin-Western can take the hills and does a great job of finish rolling"

says Mr. Joseph A. Laudato, Owner, Pittsburgh Asphalt Driveway & Paving Co.

Moving in reverse, on same job.

Pittsburgh Asphalt Driveway & Paving Co., Pittsburgh, Pa., specializes in driveway construction and maintenance—does anything from private home driveways to supermarket parking lots.

Bought portable tandem roller

Mr. Joseph A. Laudato, owner of the company, bought a new A-W tandem roller in January, 1957. His purchase was based on his previous experience with other A-W rollers, plus his confidence in the local distributor. Mr. Laudato says: "We use the A-W primarily to put the finish layer on asphalt, and it does an excellent job of giving it a smooth, fine level surface. The machine worked fast, too. On one job, a supermarket driveway, we finish rolled 6,300 yards of asphalt in an 8-hour shift."

Likes climbing ability

"One of the things I like best about the Austin-Western," Mr. Laudato states, "is its climbing ability. This is hilly country and a roller often has to work on a very sharp incline. To do a good job, the roller has to have steady power, otherwise you get an uneven, wavy surface. Driveways always come out smooth when our Austin-Western's on the job."

Maintenance extremely low

"To date," Mr. Laudato continues, "maintenance costs have been practically zero. You can put me down as a real Austin-Western booster."

The Austin-Western portable tandem roller is variable between 3½ to 6 tons. Tandem rollers are available in 5-8, 8-12, 10-14 ton models; 3-wheel rollers in 8-11, 10-12, 12-14 ton models. All A-W rollers are powered by your choice of gasoline or diesel engines, 4-speed or 2-speed transmissions, and torque converter. See your nearby A-W distributor. Or write us for complete information.

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Flagging Practice on California Scraper Job

(See Cover Picture)

THE picture on the cover this month shows several points of interest. It was taken by *Roads and Streets'* editors in October, 1957, on the contract job of Charles L. Harney, Inc., for a new expressway segment near Walnut Creek, California.

First, the scene shows how a steady succession of big scraper loads was handled across an existing highway under heavy traffic. The flagmen had their hands full, but by following California division of highways standard practice in flagging, traffic and equipment were handled safely. A large cut yardage was moved across the highway at this point for fills in the background.

● Second, and of special interest, is the wedge of protective material noted in the left foreground. The scraper operators were instructed to maintain this dike until the last, so that spillage of loose material into the highway ditch and possibly onto the shoulder or pavement would be avoided or at least minimized.

Third, and not shown here too well, is the maneuvering of scrapers so that the steepest possibly down hill load path could be utilized. This was just one of the various tricks-of-the-trade employed by Harney's project manager, Bob Kenning, on this 4.5-mile, $8 million expressway project which involved numerous interchange structures and a total of 2,200,000 cu. yd. of excavation with extensive overhaul.

● Coming back to the first point, handling of traffic, following is a letter of comment by L. A. Weymouth, district engineer of the California Division of Highways at San Francisco:

"Your color photo of equipment engaged on Charles L. Harney Company's project near Walnut Creek, Calif. showing heavy earthmoving equipment crossing an existing highway under flag control will make an interesting cover for your June issue. It is typical of contractors' operations in this area where traffic must be crossed.

"The Standard Specifications of the California division of highways defines the contractor's responsibility for the safety of the public

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All Sonoco Fibre Forms provide the most economical and fastest method of forming round columns of concrete.

For your next job choose from these three types . . .

SEAMLESS SONOTUBE® a premium form specifically developed for use where exposed finished columns are desired.

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All three come in sizes from 2" to 48" I.D. up to any length which can be shipped. Order in desired lengths or saw to your requirements on the job.

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Does the job best!

"We always use Flexcell. We like the way it works, the way it wears," says W. E. Riggin, chief project engineer for Lipsett Construction Company. Shown at the Vine Street Extension, a major link in the new Philadelphia Expressway system, Mr. Riggin is here supervising work on the project, which includes seven bridges crossing the expressway.

Flexcell bituminous impregnated fiber board bonds firmly to concrete, compresses without extruding. Re-expands to keep joints filled, preventing intrusion of dirt and stones. Uniform asphalt impregnation, 35% by weight minimum. Unaffected by temperature extremes. Tough, rigid, light in weight. Easy to cut and install. Fabricated to your specifications.

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during construction. The following clause is quoted from our 1954 Standard Specifications and clearly expresses our requirements and policy on this important subject:

" 'Whenever the Contractor's operations create a condition hazardous to traffic or to the public, he shall furnish at his own expense and without cost to the State, such flagmen and guards as are necessary to give adequate warning to the public of any dangerous conditions to be encountered and he shall furnish, erect and maintain such fences, barricades, lights, signs and other devices as are necessary to prevent accidents and avoid damage or injury to the public.

● " 'Flagmen and guards while on duty and assigned to give warning to the public that the highway is under construction and of any dangerous conditions to be encountered as a result thereof shall be equipped with red wearing apparel and a red flag or paddle type signal which shall be kept clean and in good repair.

" 'Signs, flags, lights, and other warning and safety devices shall conform to the requirements set forth in the current Manual of *Warning Signs, Lights, and Other Devices For Use in Performance of Work Upon Highways,* issued by the California Department of Public Works. And any signs furnished and erected by the Contractor at his own expense as above provided, shall be in addition to such signs as are furnished by the State as provided in article (e) of this section and shall not conflict with such State-furnished signs in intent and meaning.

" 'Should the Contractor appear to be neglectful or negligent in furnishing warning and protective measures as above provided, the Engineer may direct attention to the existence of a hazard and the necessary warning and protective measures shall be furnished and installed by the Contractor at his own expense without cost to the State. Should the Engineer point out the inadequacy of warning and protective measures, such action on the part of the Engineer shall not relieve the Contractor from responsibility for public safety or abrogate his obligation to furnish and pay for these devices.' "

—L. A. Weymouth, District Engineer, California Division of Highways, San Francisco

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LOOK AT THE No. 977 LOAD OVER 18 TONS IN 4 MINUTES— ALL DAY LONG!

This is a road construction job between Durham and Chapel Hill, N. C. Loading sand for Nello L. Teer Co. is this Caterpillar No. 977 Traxcavator, averaging 18.4 tons per load. Its load time per truck is 4 minutes, timed right on the job. Supt. R. G. Moore states flatly: "Best truck loader there is."

A few reasons: the No. 977's track roller frames are extended for better stability; its 2¼ cu. yd. bucket tilts back 40 degrees at ground level, giving leverage at the cutting edge and preventing spillage; operator sits high and comfortable, out of the dust, with all controls conveniently at hand.

New with the No. 977: a Side Dump Bucket attachment (2¼ cu. yd.) that dumps to the left as well as forward and is directly interchangeable (same pins, bolts, nuts) with the standard bucket.

But don't just look at pictures—look at the dirt fly on your own job when a Cat No. 977 Traxcavator digs in. Call your Caterpillar Dealer right now and set up an eye-opening, truck-filling demonstration.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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Sand Embankment Problems Along the Calumet Skyway

A thorough engineering study of the underlying glacial soil was made in designing the four miles of 22-foot high fill for this project.

Construction interest centered chiefly in the long hauls of borrow-pit sand and the compaction with grid, vibratory and other types of rollers.

● Semi-trailers pulled by International Model VF-192 six-wheel tractors being loaded for delivery to Arcole Midwest Corporation's project on the Calumet Skyway. Twenty-four such tractors (226-hp V-8 engines) were assigned to this earthmoving job.

By C. R. Shupe
De Leuw, Cather & Company, Engineers, Chicago

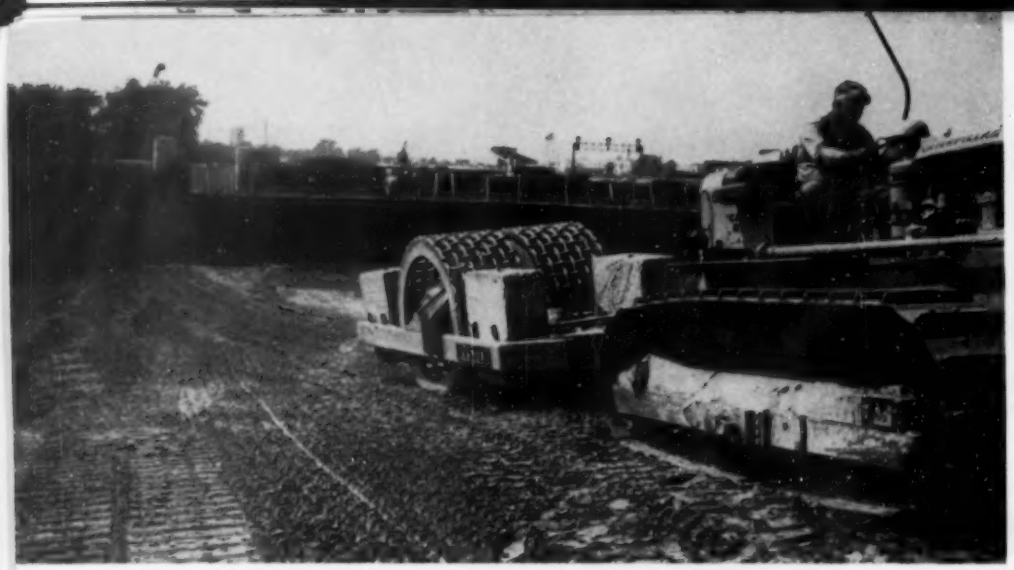
THE CALUMET SKYWAY toll bridge, as it is formally called, is being constructed for the City of Chicago under the direct supervision of the city's department of public works. Four miles of the 7.7-mile project is on sand or slag fill averaging about 22 ft. in height; the remaining portion is bridge or trestle work. Construction operation began in June, 1956, and since then pile drivers, shovels, trucks, bulldozers and mixers have been pushed under fast schedules to insure opening of the Skyway to traffic on April 1, 1958.

The project is divided into seven sections with Section Engineers assigned to each and with De Leuw, Cather & Company functioning as overall consulting engineers for the city of Chicago.

The alignment begins near 63rd and State Streets, passes through relatively congested residential and industrial areas, and ends at its overhead connection with the Indiana Toll Road at 106th Street and Indianapolis Boulevard (see Figure 1).

● *General Specifications and Construction.* The specifications, in general, for this project required removal and demolition of buildings at a cost of $360,000, clearing and grubbing for the full width of the right-of-way, and the removal and disposal of topsoil and unsuitable material to an average depth of 1.5 ft. below the existing ground line. The removal, disposal and replacement of such materials as cinders, quicksand, and muck were as directed by the engineer. No excavated material was wasted without proper permission.

In a few places it was necessary to remove satisfactory material to secure proper compaction. This was done to a depth as directed and then an additional 6 in. of material was thoroughly loosened



● Hyster grid roller with concrete weights, as used on J. M. Corbett Company's sections of the Calumet Skyway.

and compacted according to specifications. The excavated surface was then replaced and compacted in 6-in. layers.

Roadway embankment was specified to be placed and compacted to a maximum elevation of 6 in. below subgrade elevation with granular materials composed of either dune sand, lake sand, pit sand or crushed open hearth slag, crushed blast furnace slag, rock or gravel. The material was required to be uniformly graded, with from 0-10 percent passing the No. 200 sieve. Fine granular material consisted of particles 95 to 100 percent passing a No. 4 sieve and medium granular material, including gravel or crushed slag and rock 100 percent of which passed a 4-in. sieve.

The final 12 in. fill depth (to template grade) was classified as Special Granular Embankment composed of granular material grade 7, 8 or 9.

All fill material was specified to be placed in successive horizontal layers of not to exceed 6 in. in compacted depth for the entire embankment width. Placing of embankment was done according to AASHO Specifications to secure an "in place" density and a moisture content of not less than nor more than 5 percent of optimum. As directed, the embankment was compacted to not less than 95 percent of maximum density to a point 6 in. below template grade. The remaining 6 in. was compacted to 100 percent of maximum density for the full cross-section width.

As the 6-in. layers of compacted embankment progressed, each 3 ft. of lift was test rolled by making two complete passes with a 50-ton pneumatic-tire roller. After the test rolling the upper 6 in. was scarified before embankment filling continued. The final 6 in. to template grade was also test-rolled.

Values used as the basis for control of "in place" density and moisture content were determined in accordance with AASHO Specification "Standard Method of Test for the Compaction and Density of Soils" Designation T-99. Tests for "in place" density were made in accordance with AASHO Specifications "Standard Method of Test for the Field Determination of Density of Soil in Place," Designation T-147.

Soil and geologic conditions were determined by collecting and collating all available data on soils encountered in building foundations in the area; making additional soil borings and laboratory tests of soil samples by the city's bureau of engineering, department of public works. Sources of information utilized, among others, were:

"Chicago Area Geologic Maps," by J. Harlen Bretz, Illinois State Geological Survey of 1930-1932; "Engineering Properties of Chicago Subsoils," by Ralph B. Peck and William C. Reed, University of Illinois Engineering Experimental Station Bulletin 423, Urbana, 1954; and "Geology of the Chicago Region," by J. Harlen Bretz, Illinois State Geological Survey, Bulletin 65 (Part I), Urbana, 1939.

● Sites of borrow pits No. 1 and 2 in relation to the Calumet Skyway.

The Cary Substage of the most recent ice sheet, the Wisconsin, left the soil deposits upon which the Calumet Skyway Toll Bridge was built. During this period a number of distinct till sheets, each having its own terminal moraine, were deposited in the Chicago area. The first, found upon the bedrock underlying the roadway location, is the Tinley Moraine consisting of hard blue-gray silty clay with some sand and gravel. The approximate elevation of the surface of this material lies between elevation -15 and elevation -45 (Figure 3). As the Wisconsin glacier retreated northward from the Tinley Moraine the glacial ancestor of Lake Michigan, known as Lake Chicago, was formed with a surface about 55 ft. above the present Lake Michigan. Deposited beneath the waters of this lake were the Park Ridge and Deerfield Moraines. The stiff blue-gray silty clays located with a surface elevation between elevation -2 and -16 consist of Park Ridge Till. A small pocket of the Deerfield Moraine is found at the northern end, in the form of medium soft blue-gray clay.

Present ground water elevation along the proposed route is located within the yellow-brown sand (solid arrows, Figure 3) at approximately Elev. +3.

Except for the small pocket of compressible blue clay located at the northern end of the route, all of the clay strata are commonly considered relatively incompressible and are used to provide support for pile structures throughout the Chicago area.

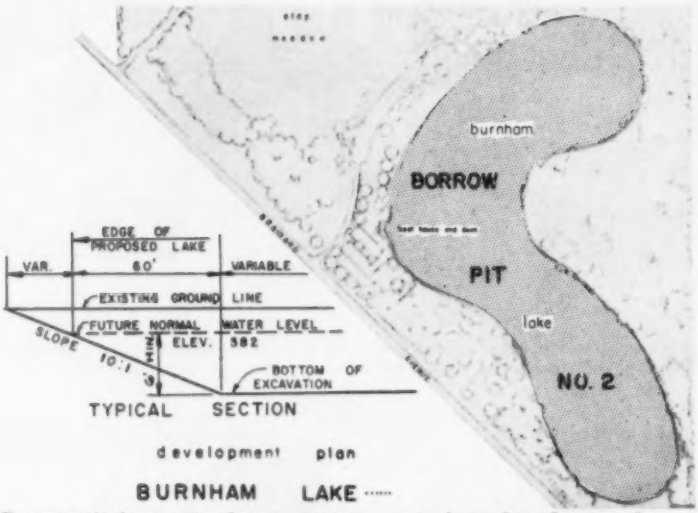
● **Essick tandem vibrating rollers pulled by Cat D6 compacting granular fill. This type of roller was used continuously. Corbett project on Skyway.**

● **Mack 22-yd diesel semi-trailer dumping fill at Skyway embankment in Corbett's section. Nine haul trucks made 10 roundtrips per day to borrow pit, covering 180 miles each.**

● *Two Borrow Pits.* Two sources of material for embankment, exclusive of slag, were used in completing this project. Pit No. 1 is located on the Illinois side of Wolf Lake and is under the jurisdiction of the Illinois Conservation Department from which permission was received to remove the necessary excavation. Pit No. 2 lies in Burnham Woods, within the Cook County Forest Preserve District.

Sand from Pit No. 1 was removed by the Kenny Construction Com-

● **Compacting fill at Corbett's section of Skyway. Hyster grind roller with 28,000-lb. weight is drawn by Cat D7 to do compacting, while D8 does spreading after fill is dumped.**



● Borrow pit in county forest preserve—note irregular shape and prescribed depth and shore slopes, designed to make a lake. This lake and surrounding picnic grounds provide a recreation area for the public benefit.

pany of Skokie, Illinois. In the excavation operations, the depth of Wolf Lake was increased approximately 15 ft. The required area was diked off into three sections, ditched and pumped to lower the water table, and then all unsuitable material was removed. Haul roads, spaced about 30 ft. apart and constructed of hard slag, were set up in network fashion between the diked areas. Equipment used in two 10-hour shifts consisted of two 3-yd., one 4-yd., and one 2-yd. draglines plus heavy dozers. Material was hauled to the site by a fleet of International 22-yd. dumping semi-trailers. Average length of haul was about 10 miles and the total excavation from Wolf Lake was more than 1,500,000 cu. yd.

It is interesting to note that during the construction of the Indiana (East-West Toll Road in 1956, 2,000,000 cu. yd. of Wolf Lake Sand (on the Indiana side) was dredged and used for embankment. Since both the Indiana Toll Road and the Skyway involved large fill quantities, and acceptable borrow was scarce, it can truly be said that nearby Wolf Lake has been a windfall.

In the operations to secure material from Pit No. 2 in Burnham Woods, a 28-acre kidney-shaped artificial lake was created. Excavation in this area was performed by the Arcole Midwest Corporation of Evanston, Illinois, using a fleet of 24 units of 22-yd. dump TEC semi-trailers pulled by International Model VF-192 six-wheel tractors operating up to 22 hours a day. The semi-trailers are 22 ft. long and bodies could be raised to a 45 degree angle by a single telescopic hoist. Round trip through city traffic, some 12 miles each way, resulted in about 8 or 9 loads per unit per 10-hour period. Excavated material was loaded on the trucks with Northwest 80D cranes and Hendrix 3-yd. perforated dragline buckets. Bulldozing in the pit was done with International TD-12 and Allis-Chalmers HD-14 tractors. Total excavation from Pit No. 2 was upward to 650,000 cu. yd.

Some material from both Pits No. 1 and No. 2 was also supplied to other contractors on the project.

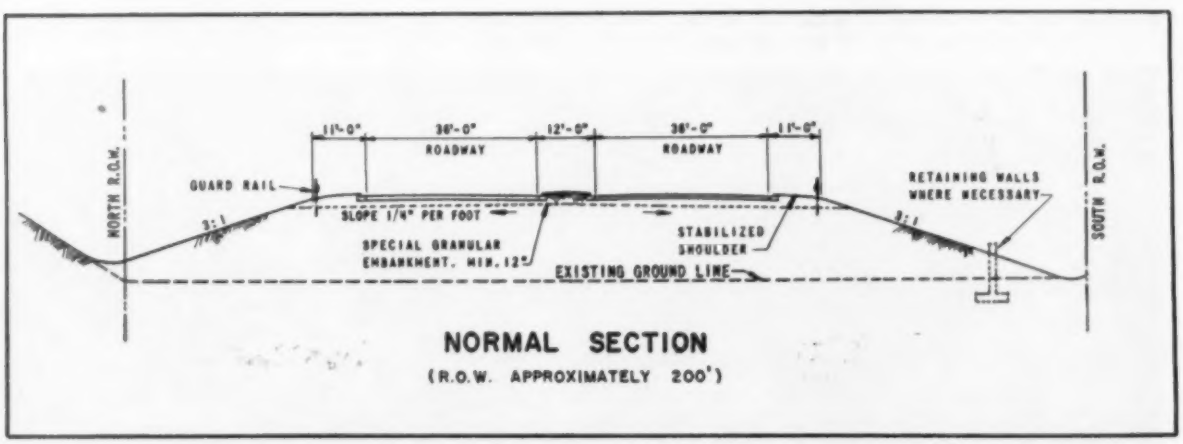
Contractor Filling Methods Compared

Section 1-A-2, Arcole Midwest Corporation

This section is about 3,800 ft. in length. Bid price for embankment was $2.35 per cu. yd. in place. Embankment totaled 429,000 cu. yd., including some 59,000 cu. yd. of granular slag and 370,000 cu. yd. of Pit No. 2 material.

A total of 2½ ft. of existing material was stripped previous to the placing of embankment. As was true in all other stripping sections in this project, the excavated material was mostly man-made fill consisting of everything from old rubber tires and tin cans to boxes and bedsprings.

Compaction operations were performed with Vibro-Plus Terrapac 3½-ton vibrating steel rollers pulled by Caterpillar D6s. Compaction adjacent to retaining walls and abutments was obtained with Jackson tampers.



● This is the cross-section to which the fill sections here described were constructed.

● Embankment placement — looking northerly from Colfax Avenue — Contract 4-B-2.

Section 1-B-2, Hedges Construction Company

This 4,000-ft. section, requiring 500,000 cu. yd. of material from the Wolf Lake pit, was bid at $2.15 per cu. yd. for excavation.

Sand from borrow pit to site was transported by 23-yd. Fruehauf semi-trailers with dump bodies, pulled by International No. 230 diesel tractors. About 8 or 9 loads per day per unit were delivered over a 21-mile round trip through heavy traffic.

In addition to the 1½ ft. removal of existing surface required by specification, an additional 31,000 cu. yd. of unsuitable material was excavated previous to the placing of embankment. This was handled with a Northwest 1-yd. dragline and an International TD-24 dozer at the rate of about 500 cu. yd. per day.

● As the embankment lifts progressed it was necessary to construct haul roads within the area to accommodate the heavy semis. These haul roads, construction of crushed limestone, were staggered laterally as the fill advanced. A 3-ft. sand cushion was permitted between each haul road lift. This was common practice on many of the other sections with the exception that most of the contractors used acceptable granulated slag. All haul roads were compacted in 6-in. lifts and ultimately became part of the total embankment.

Compaction operations at the rate of 3,000 cu. yd. per 20 hour (2 shift) day were completed using a Hyster Grid Roller, Vibro-Plus Terrapac and a 50-ton Grid Roller; heavy tractors were used for power. An International TD-18 tractor was used for side slopes and other light work.

Material behind retaining walls and abutments was compacted with a Jay tamper (1,200 lb. impact) and, where circumstances permitted, the Grid Roller was used. Embankment operations were completed in approximately 37 working weeks.

Section 2-A-2, Arcole-Midwest Corporation

This 1,900-ft. section was awarded at a bid price of $2.48 per cu. yd. and included about 216,000 cu. yd. of embankment, half sand and half slag. Stripping operations, source of material and compaction procedures were similar to those used in Section 1-A-2.

Section 3-A-1, R. R. Anderson Company

This 3,600-ft. segment was bid at $2.40 for embankment totaling 280,000 cu. yd. Source of material was Pit No. 1, with round trip haul of some 18 miles (10 trips per hauler in 8½ hours). Hauling began in March 1957 and ended in September. Equipment to transport the fill from Wolf Lake was primarily 6-wheel White and 6-wheel Mack trucks. Work shift was a 9-hour day, 6 days per week and the rate of compaction was approximately 4,000 cu. yd. per day.

Compaction was performed by a 3½-ton vibratory roller, 50-ton pneumatic-tire roller and Essick tandem vibrating steel rollers pulled by Caterpillar D6. Compaction near abutments and retaining walls was done with Jackson vibrators and hand tamping.

Section 4-A-2, J. M. Corbett Company

The embankment price was $2.15 and the quantity 515,000 cu. yd. Fill material consisted of about 100,000 cu. yd. of both air-cooled and water-cooled slag. The remaining yardage was obtained from Pit No. 1 (Wolf Lake). Transport was by 24-yd. Fruehauf dumping trailers and TEC trailers pulled by Mack B-52 and B-63 trucks. Although this 18-mile round trip haul was through relatively busy city traffic, it was possible to make an average of 8 trips per unit per 10-hour period. Stripping of unsuitable debris varied from 1½ to 5 ft. or more and disposal required considerable hauling.

Two Hyster Grid rollers, Type GC, were used exclusively for compaction. These Hyster rollers, each weighing 16,000 lb. and loaded with four 1,000-lb. concrete ballast blocks, were towed by Caterpillar D7 tractors at 8 to 10 mph. To secure the required density, four to six passes were necessary.

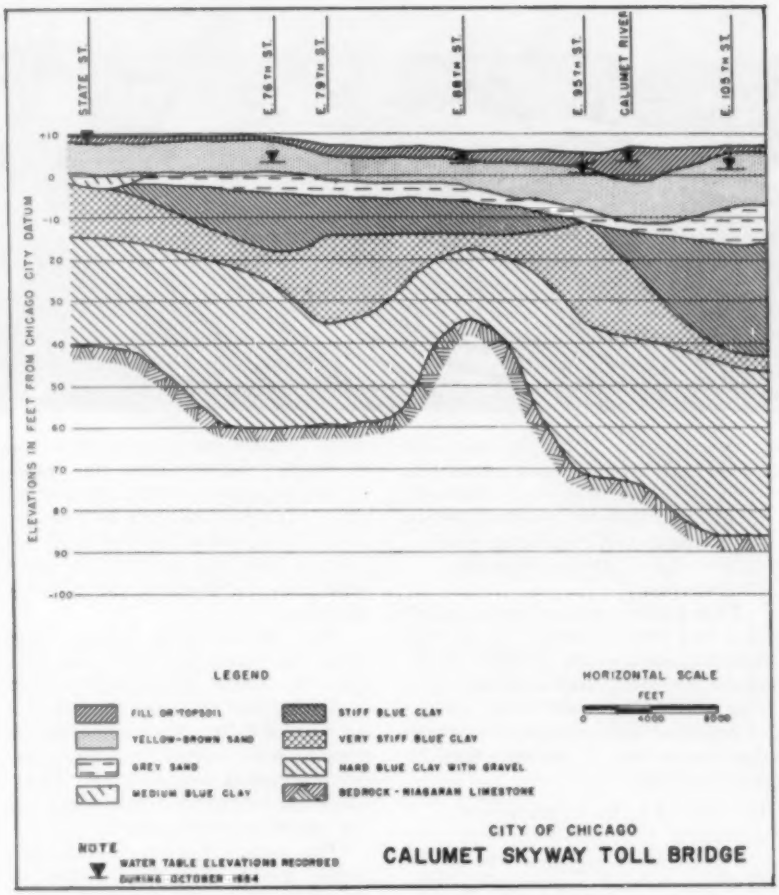
The contractor on this section began using sheepsfoot rollers, a Ferguson 50-ton roller and small vibrating rollers, but eventually confined his activities to the Hyster rollers. Hyster equipment on this project was highly complimented and thought to be most effective in reducing the voids in compacted sand due to its horizontal and vertical kneading action.

Density tests throughout this project were made with a Soiltest Volumeasure CN-980. Hyster equipment in this section produced compaction reading between 97 and 103 percent. Fill was compacted on an average of about 4,000 cu. yd. per day.

Section 4-B-2, Kenny Construction Company

This 2,800-ft. section, requiring 465,000 cu. yd. of embankment, was bid at $2.10 per cu. yd. Before placing the embankment, it was necessary to remove the usual 1½ ft. of undesirable material plus an additional 40,000 cu. yd. classified as "Roadway Excavation" in the specifications. Various types of shovels were used.

With the exception of about 93,000 cu. yd. of "pop-corn" granulated slag (water cooled from open



● **Geological profile of the area under the Skyway. This information was gathered in a thorough study as a basis for embankment design.**

hearth furnaces), the main source of fill material was Pit No. 1.

The contractor began operations using two 10-hour shifts—one during the nighttime—but because of weather conditions, lighting, economy and public complaints about noise, the evening activities were abandoned. The average daily rate of embankment construction, using one shift, was 4,000 cu. yd. with peaks of 7,000 cu. yd. Embankment operations were completed in about five months.

Equipment used for compaction consisted of Hyster Grid Rollers pulled by crawlers, or by a LeTourneau-Westinghouse Tournadozer; plus Terrapac vibrators pulled by various available tractors. The 50-ton pneumatic-tire rollers were also used for compacting the 6-in. layers where practical. Compaction behind retaining walls and abutments was obtained with "pogo stick" air tampers and pneumatic-tire rollers.

Section 5-A, Kenny Construction Company

This 3,600-ft. section was awarded at a bid price of $1.72 per cu. yd. for embankment in place.

Previous to the placing of fill, 41,000 cu. yd. of unsuitable material was removed using Lorain and Bucyrus-Erie shovels and dozers. Stripping progressed at about 2,000 cu. yd. per single shift day. Maximum unsuitable material was 5 ft.

Approximately 390,000 cu. yd. of fill was used and placed at the average rate of 3,000 cu. yd. per 10-hour day. During the cold months, a second shift working 8 hours per day was added to beat the "frost" situation.

Pit No. 1 material was transported by 6-wheel trucks and 22-ft. semi-trailers.

Most of the embankment was compacted with Terrapac vibratory rollers. Fills behind abutments and retaining walls completed with Barco tampers.

Special Provisions
By the Cook County Forest Preserve District For the Removal of Material from Borrow Pit No. 2 for use on Skyway embankment

1. All equipment operation, roadways and storage areas outside the limits of excavation was restricted to specific areas designated by the district.

2. No cutting of brush or cutting or trimming of trees permitted outside the designated limits of operation.

3. All brush, stumps, roots, tree parts and debris to be disposed of by the contractor. Disposition of such materials permitted by burning at locations designated by the district, providing the contractor furnished watch services at all times and until fires are completely extinguished.

4. All topsoil within the limits of excavation had to be stripped and stockpiled at locations selected by the district.

5. Excavation to be started at the southeasterly end of the pit, and pit completed to the typical section as the work progressed.

6. Any adjustment in quantities of materials required made by altering the depth below a designated elevation.

7. The contractor was allowed to fill swales and depressions outside the limits of excavation with surplus earth material, providing the topsoil was first stripped and stockpiled from such areas and such filled areas are shaped to blend with the adjacent ground surface, properly drained and left in a reasonable smooth condition.

8. Sole responsibility of the contractor to protect all existing utilities and to repair and/or replace any damage thereto.

9. After the completion of the excavation, all ground surfaces above the existing water level within excavation limits, and all other surfaces disturbed by the contractor's operation, were to be graded and shaped to blend with adjacent ground surfaces, properly drained and left reasonably smooth.

10. All construction roads to be obliterated and all debris of every description resulting from the contractor's operations removed, and premises left in an orderly and neat condition.

GET BEHIND YOUR HIGHWAY DEPARTMENT

STATE HIGHWAY DEPARTMENTS which are handling such a volume right now are in need of help from citizens, more than criticism. Those best able to help the departments, and in so doing help get more work under contract faster, especially include people familiar with highway problems—contractors, material suppliers, equipment distributors and manufacturing executives.

One of the best ways to help is to attend the hearings being held to secure community approval of expressway or by-pass relocations. It seems that only the irate go to such affairs! The state highway leaders are spending a lot of their time getting locations approved and right-of-way questions ironed out. A highway industry man who is not identified with the road agency, but speaks up as a private citizen and taxpayer, can do much to explain the necessity of planning new expressways for bee-line traffic movement, fully protected from the hazard of cars turning in and out to patronize fronting establishments. There is a great deal of case history material now to show that local business as well as the traffic stream usually benefits.

You, Sir, as Mr. Citizen also have an opportunity to offer your services on committees concerned with sound highway development; to give counsel to state legislative groups studying roads; to speak or secure speakers at luncheon and civic clubs; and to lend a hand with ideas for getting young men interested in highway engineering careers.

The American Road Builders Association, by the way, has a series of education films on such subjects. Helping to get these films shown around your state is an idea worth a letter to ARBA headquarters, World Center Building, Washington, D.C. (or local ARBA contractor chapter).

Briefly Noted . . .

THIS IS THE YEAR that is separating the men from the boys with respect to the kind of highway departments the states' legislative and political leaders have encouraged to develop and flourish.

Never, it seems, has there been a greater range of performance, now that a great deal more money has been made available for highways. Some state departments will continue to lag in getting the "recession" type jobs under contract, while others will place most of their share of the $400 million of special federal money up for project bids by early summer. This quickie program will all get under the wire by year-end, no doubt. It's in the Interstate projects that the greatest disparity continues to show.

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Contractors are wondering in some states whether the road program will turn out to be more and more profitless as the dollar volume rises. The Price Index is down slightly, and the number of bids per job higher in a good many states. But more than one contractor association is warning its members that no reduction is in sight in labor rates. Labor costs underpin every item, beginning back in the quarry and equipment factory. Right now when business is soft many a truck owner may be willing to rent out cheaper, and other suppliers and purveyors may feel like making concessions. But who can guess where costs will be a year or more hence, when the package jobs being bid now get into stride?

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The emergency $400 million program—requiring that the state allocations be put under construction contract this calendar year—may have considerable effect on department procedures. The permissible ways to eliminate red tape, on which AASHO leaders were briefed in Chicago a few weeks ago, might show that certain short cuts can be made permanent. It depends on the abuses that do or do not develop. One procedure—that of submitting a whole program of jobs to the Bureau for approval under one project agreement—will particularly be interesting to watch.

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The $400 million program will call for some careful definitions, when it comes to jobs such as widening, overlays and other improvements of existing facilities. The Bureau's ruling that project must represent definite upgrading of a road, or "capital investment," brings up the word "maintenance." Maintenance projects will be ruled out, but just what is maintenance? This is asked particularly after the terrific spring break-up that has just occurred in many of the eastern and southeastern states.

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Reminds us of the story carried in a national magazine some years ago about a contractor whose name is now among the colossals. He based his bids on the gamble that prices would drop through the period of his contract, and in so doing he landed a lot of work. Since this was in the early 30's, he also won his gamble. Many contractors seem to be making the same gamble today. Will we be attending their funeral some day—or borrowing from them?

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An opportunity to add decisively to the safety of existing highways lies right under the nose of every highway and street department. That is the addition of dividing strips along 4-lane roads or streets which do not presently have such dividers.

A recent study by the Michigan state highway department indicates that 4-lane divided highways with complete control of access are almost four times as safe as other trunk line highways, but that 4-lane undivided roads without access control are the most accident prone and dangerous roads in the state.

It is granted that the difference between these two types with respect to safety is partly accounted for by the access control. But dividing strips—specially when installed in conjunction with left-turn storage lanes at intersections and with better signalling—can save a lot of smash-ups.

And this is a relatively low-cost type of improvement that takes very little design room effort.

Caterpillar DW20 (Series E) Tractor with No. 456 LOWBOWL Scraper is pushloaded by a D9 Tractor equipped with a pushcup. With eight other DW20s it is working on construction of runways, taxiways and other facilities at Bergstrom A.F.B., near Austin, Texas. Altogether, the DW20s are getting up to 20,500 cu. yd. in a 20-hour working day on hauls of 1 to 2½ miles round trip.

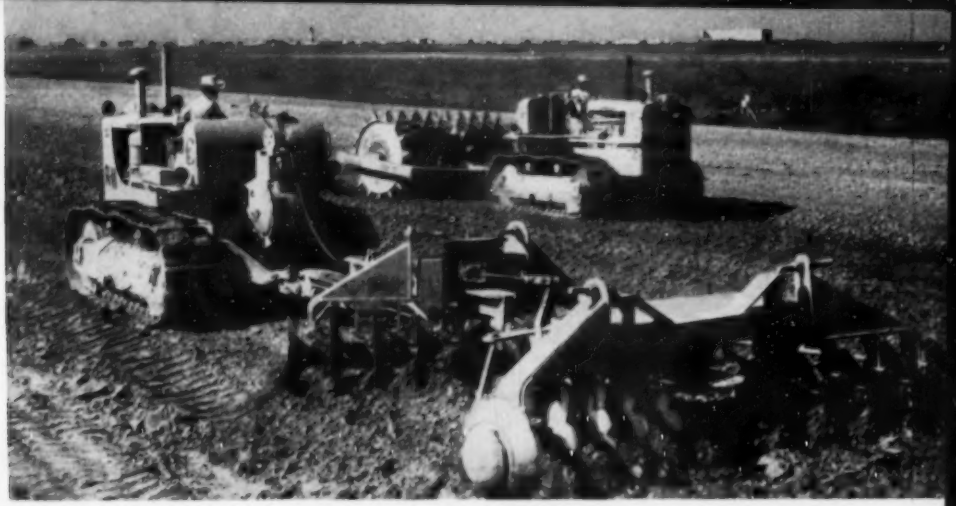
Job report on Bergstrom

Nine DW20 Tractors and 17 other pieces of CAT-built equipment are at work on this 2,370,000 cu. yd. project.

Near Austin, Texas, the H. B. Zachry Company is building runways, taxiways and other facilities for the new Bergstrom Air Force Base. This is a big operation—2,370,000 cu. yd. of excavation. In addition, it calls for 300,000 yd. of select base material and 503,000 yd. of concrete pavement. The runways are 12,250 feet long, 300 feet wide.

Work started in April, 1957, and is being handled by nine DW20s (Series E) with No. 456 LOWBOWL Scrapers, two D9 Tractors, six D8s, two D7s and seven No. 12 Motor Graders.

The DW20s are getting up to 20,500 cu. yd. in a 20-hour working day. Rough material, too—clay, limestone conglomerate, shale and black gumbo. Round-trip hauls have varied from 1 to 2½ miles.



Caterpillar D8 Tractor pulling a disk harrow and a D8 pulling a sheepsfoot roller are among many pieces of Caterpillar-built equipment working on runway construction. The D8s feature dependable Cat Engines, operator-convenient, power-boosted controls and built-in quality for long life.

Seven No. 12 Motor Graders level fill on runways in preparation for base. Performance records show Cat-built machines are the most economical to own and operate in the long run.

A. F. B. construction

Now a new DW20 (Series F) Tractor is available. It features the Cat Super-Turbo Engine that provides 320 HP (maximum output) . . . 28% torque rise . . . top speed of 35.8 MPH! Results: faster cycles, greater production and more profit —*for you.*

Get the full story on efficient, economical Caterpillar-built earthmovers from your Caterpillar Dealer. He'll demonstrate right on your job, give you expert advice. After you buy, it becomes his personal responsibility to keep your machines *at work* by providing prompt service and quality Caterpillar parts if needed.

. . . for more details circle 253 on enclosed return postal card

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

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WANTED—
THE HARD WORK

Faster, More Powerful, Yes! But—

Is Oldtime "Stuff" Missing?

A Contractor's-Eye-View of

The mechanical superintendent of one of the nation's largest road contractors issued a challenge to equipment designers attending the recent SAE Earthmoving Conference.

THE BOSS-MAN of one of the largest contractors let go with both barrels recently on the need for still better equipment.

This blunt yet careful-speaking critic was D. A. Armstrong, equipment superintendent of S. J. Groves & Sons Company. He aired his ideas as one of the speakers at the 9th Annual Earthmoving Conference, held April 15 and 16 at Peoria under the Central Illinois Section of the Society of Automotive Engineers.

Armstrong spoke in part from a prepared paper, which is reproduced in these pages with the permission of the author. He also ad-libbed freely giving direct replies on questions from the audience during a long and spirited discussion that followed his prepared paper, which is published herewith.

• • •

S. J. Groves & Sons Company is primarily in the dirt-moving business building highways, dams and airports. Because of the nature of this business, we require earthmoving equipment, and so we must be very equipment minded. Considerable thought and study are given to the purchase of our equipment; it has to do a good job to make money for us.

In purchasing the equipment, we have to evaluate many items. We do this from our past records and experiences, knowledge of the manufacturers' previous products, the dealer, the service that can be rendered, the service ability in maintaining the unit, the availability of parts, and many other pertinent facts. We purchase new equipment mainly through our own experience, with knowledge of the unit through dealers and other owners. We have to justify the purchase of machines as to their multi-use and year-'round operation, to their versatility and their productivity and cost.

We attempt to standardize on equipment as much as possible because, during any year, our equipment is transferred to new locations with different personnel. By standardizing the equipment, our parts inventory is cut down, as is the need for familiarizing our people with fewer styled units.

This standardizing increases our availability and by doing it in this manner, we are able to have our equipment earn money for us with greater efficiency.

● *Preventive Maintenance.* The training of our supervisors in the field with Preventative Maintenance is vitally needed to take care of our investment. Preventative maintenance is a big factor. In the setting up of a preventative maintenance program, many difficulties are uncovered. The paper work that is necessary to keep detailed records of what was done, the costs and hours of a machine, and the machine's productivity, are all handled by people who are not mechanical engineers, but who do have an engineering approach and appreciate the need for good records.

The largest problem with preventative maintenance is the follow-through. The paper work and data necessary must be taken care of by supervisors, who in turn have to be convinced that there is a need with proper rewards. Results cannot al-

ways be shown to them day by day, but only over a period of time.

Although it takes only a few minutes of paper work and a few hours of actual manual work in the preventative maintenance program, we must realize that this constitutes a considerable amount of non-productivity. This fact, coupled with the total number of units, represents a staggering total of non-productive time at the end of the year. These units could have produced during the time they were having preventative maintenance checks. That is why there is this thought in mind. "Run it until it breaks down, then repair it." This feeling lately has been based in part on the fact that certain of today's component assemblies are being replaced

There is a definite need for schools, regardless of who puts them on, be it the dealer or the manufacturer, in acquainting us with their product and its operation and service.

● *Component Assemblies.* We find more and more component assemblies than previously. Depending on our projects and the facilities that we are able to provide, we have done a certain amount of exchanging with the dealer on an exchange basis. But where we have district shops and the facilities, we would rather take our components there for overhaul and repair than to a dealer. By doing this, we eliminate the question in our mind, "Did this unit require all the necessary parts that the dealer's men installed?"

Earthmoving Equipment Design

in their entirety before there are enough hours on them to have a check in the preventative maintenance program.

It is a necessity, however, and requires the full cooperation of each man in connection with each project, to carry out a preventative maintenance program. In the past ten years, we have seen a great development of new and different models of earthmoving equipment. We have also seen an increase in horsepower, new style power trains, torque converters, oil clutches, booster controls and other changes of design which have all increased our preventative maintenance problems.

● *Down-Time Growing.* While the units are moving with their greater speed and power, down-time and preventative maintenance increase. Designers have not proportionately taken care of the other problems along with their design changes in increased power, etc. The change in design which influences our purchasing and creates more preventative maintenance has increased our service problems.

We have to look to the dealer and the manufacturer in aiding us in the servicing of the newer units more than ever before, for a better knowledge of operation and servicing.

In many instances, we find that our field men and equipment supervisors are more aware of the servicing problems and how to take care of them, than are the dealer servicemen and sometimes the manufacturers' field representative. We often find a great lag between the production of a unit and the service and knowledge that are needed when the unit is put into the field. There is too much of a gap between the dealer servicemen, factory servicemen and contractor.

We are faced with the dealer not having an exchange unit on hand and the amount of time before he could rebuild the unit. We are both faced with the problem, "Do we have the parts on hand to rebuild it?" The exchange program depends so much on the dealer, his type of territory, and whether he cares to invest his money in exchange units as it may occur to him that this is only a seasonal problem, or that the problem is only as lengthy as the project.

So, when we do have the facilities and the knowledge of the rebuilding, it behooves us to do our own work, and eliminate that ever present problem of warranty and whether or not we took the correct care of it since he is subjected to the rebuilding by his own personnel, just as we are.

● *Dealer Service.* There is a great need for a closer relationship between the service departments and the contractor. The people that use the machines in the field have a job to perform that is difficult. The problem is time, which is of the essence. When we lack service and availability, these people become prejudiced against a machine, and rightfully so. This in turn reflects on our purchases of equipment.

I recall an instance last year where we were having head problems; the dealer and the manufacturer were replacing the motor heads on a warranty basis. It was only by accident that, seven months later, after a service bulletin had passed from the factory to the dealer, we found upon changing to the new style heads that there was a water pump replacement which should have been installed at that time. Yet, the manufacturer kept warranting the heads and the servicemen kept applying them. We cannot afford to have such things happen, nor can the manufacturer. But it does.

I believe a good understanding between the design engineers, the service people and the contractor would tend to eliminate many problems that we have in the field today.

You all surely agree that service along with available parts, and the knowledge of what a machine is capable of doing, will sell more machines than all the good talking a salesman can do.

This brings us again to a big problem, and a very costly one. Down-time. We try to take care of down-time by preventative maintenance, servicing, and by the use of recommended parts. Many factors go into causing down-time. A great deal of it is design, operators, and the type of project. There are several ways in figuring out what down-time costs you. One way is to figure what the unit would be able to produce had it not been down. By that, I mean that the unit, for instance, was moving 100 cu. yd. an hour at .40 cents a yard, and it was down for two hours; $80 would be spent. The part that failed cost $5 and the mechanic took two hours to fix it making $8 with a total of $13 —a considerable difference.

Many other things can be added to this. I don't believe that you can truthfully tell until the end of the job that it took so many more days, so many more working hours, and so many more dollars and cents than would have normally been required.

In our 1957 season, we found that:

• 20% of our down-time was caused through lack of parts.

• 35% was due to external problems. By this, I do not mean engines, transmissions, torque converters, differentials, planetary systems, etc. I mean those items that are on the outside of a machine such as sheaves, cable, hoses, structural failures, etc.

We appreciate the fact that it takes design and theory on external parts, but there is room for a lot more good common sense in the way these external items are installed, and of what they are composed.

• We need a better air filtration system to take care of the increase in quantity of air that is required for these newer style, higher-output engines.

• We need a heavy-duty electric system to replace the present type products. We are doing more and more night work to get the full utilization from our equipment because of its present day costs.

• We need fully sealed bearings in sheave assemblies.

• We need better plumbing systems for the transfer of air or hydraulics.

• We need better styled cable and hydraulic systems.

The object of our equipment, gentlemen, is to produce, not to be down for constant service, preventative maintenance checks, or admiration. Admiration only comes when a unit has done a job well, and has earned money for you. Much of this can be accomplished at this time in the change of outside designs and parts with more common sense and less theory.

Highlights of Armstrong's Further Comment and Floor Discussion

In his Peoria talk Mr. Armstrong spoke with the authority of an executive in a $100 million-a-year, multi-job construction firm which keeps careful equipment cost and production records, this speaker said that—

• Engines and machines are wearing out faster today. Track assemblies, for example, are good on the average for only 1,600 to 1,800 hours, compared with 3,500 hours formerly. The interval for a tractor may even be less under severe conditions.

• Preventative maintenance is more of an uphill task now—another price paid for higher speed and greater horsepower. Many components wear out before preventative maintenance time rolls around. Many require overhauling before the season is over.

• Down-time has increased under the tempo. The 50-minute hour is gone. Groves' well-cared for machines average 41 minutes.

Engines are the chief problem. They have been repeatedly beefed up in the postwar race for more equipment speed and horsepower, and "it is time for a basic redesign."

• The external components in turn are the chief source of trouble—the cables, piping, wiring, pumps, etc. Much basic redesign is suggested here, for greater heat resistance, sturdiness, easy accessibility.

The externals accounted for 35 percent of Groves' equipment down-time.

• Preventative maintenance, while requiring increasing management attention, can easily be overdone. Armstrong questioned the economic justification for too-frequent checks.

Parts supply is a vital phase of dealer service that needs another look-into, also, said Armstrong in his discussion period. Over 20 percent of Groves' down-time was due to lack of parts when needed.

• On the fine points of engine design—"We'd like a better air filtration system . . . a really heavy-duty electrical system for night use . . . fully sealed lifetime bearings in sheaves (when they go, they go) . . . better control systems . . . better cooling (air in the block often causes hot spots, cuts engine life) . . ."

• Fuel consumption today is a great variable between some models that are otherwise comparable. One unit cited by Armstrong, used 10 gal. of fuel per hour, and a similar model 18 gal. At 16 cents per gal., this adds up to $1.28 per hour difference, or $2,560 saving in a 2,000 hour season for the more economical machine . . . "Yet low down-time is more desirable than fuel economy."

• On speed of operation: "I've yet to see a contractor who wouldn't rather give up speed for sureness that he will be working tomorrow . . . We need the weight more than the speed."

• On the use of torque converters, "We have asked ourselves: have they increased the work done, cut maintenance, added to the equipment life? We don't think the torque converter has always come up to predictions. Rebuilding machines which have such drives is more costly, for example . . . The operator hasn't always been taught or made able to use torque converter equipped machines intelligently according to the work and load conditions." The chief concern with torque converter is overheating, it was inferred, and this is tied in with the problem of increased horsepower as well as with failure to select proper gear ratio and operator handling generally.

• On the subject of operators, Armstrong said that the day of the operator who is proud of his machine is gone. When asked whether the unions shouldn't be urged to take a responsibility for operator training, he said, "we'd welcome it," but expressed doubts that this could come about.

We need the manufacturer's help and influence here, he noted. Our equipment troubles are chiefly due to "pilot errors".

Armstrong urged more training programs conducted by dealers, with whom the contractor has his day-to-day relationship.

(Continued on page 86)

End Maintenance Complaints! Salt Stabilize Your Gravel Roads

Build better roads that keep everybody happy by stabilizing with Morton Salt

As a wearing course, salt stabilized roads give motorists a smoother, safer ride and create less dust. When you stabilize with Morton Salt you get the added satisfaction of putting in roads with durable surfaces which reduce frost action, minimize loss of expensive aggregate (the savings in aggregate alone more than pay for the salt), and require far less maintenance.

As a base course, Morton Salt stabilized roads form an ideal bond with most types of bituminous material. With added stability, increased load bearing strength, improved bond and controlled frost action, salt stabilizing reduces the need for most costly and heavier surface courses.

Please send me
your free booklet
on salt stabilized roads.

Name_____
(Please print)

Title_____

Address_____

City_____ Zone____ State_____

MORTON SALT COMPANY
INDUSTRIAL DIVISION
Dept. RS-658, 110 N. Wacker Drive
Chicago 6, Ill.

. . . for more details circle 304 on enclosed return postal card

Sodium Chloride Stabilized Base Secondary Project

1 Morton Salt Formula No. 10, sodium chloride is being applied to the base material.

SODIUM CHLORIDE stabilization was used during 1957 on a secondary project, a 4-mile state road near Hopkins in Wake County, North Carolina (there being no such thing as county maintained roads in the state). The base material consists of well graded sand loam, bladed on to the roadbed from side ditches.

Sodium chloride was applied at the rate of about 3 lb. per sq. yd. for a 4-in. compacted depth. The base material was scarified and thoroughly pulverized with two Seaman mixers pulled by two International I-D 9 wheel-type tractors. The sodium chloride was applied to the pulverized base by Chevrolet 1½-ton dump body trucks equipped with Burch spreader gates. Water was next added by gravity from 1,000-gal. water tanks loaded on one and one-half ton Chevrolet dump trucks.

2 Water being applied to base immediately after application of sodium chloride.

3 Seaman mixers making initial mixing of base material and sodium chloride after water has been applied.

The mixers were used again to thoroughly mix the sodium chloride with the base material. The mixed material was then cut from the center to the outer edge of the road using three Galion No. 118 motor graders. After shifting and thoroughly mixing the base material with sodium chloride, the road was machined to its proper cross-section and thoroughly compacted.

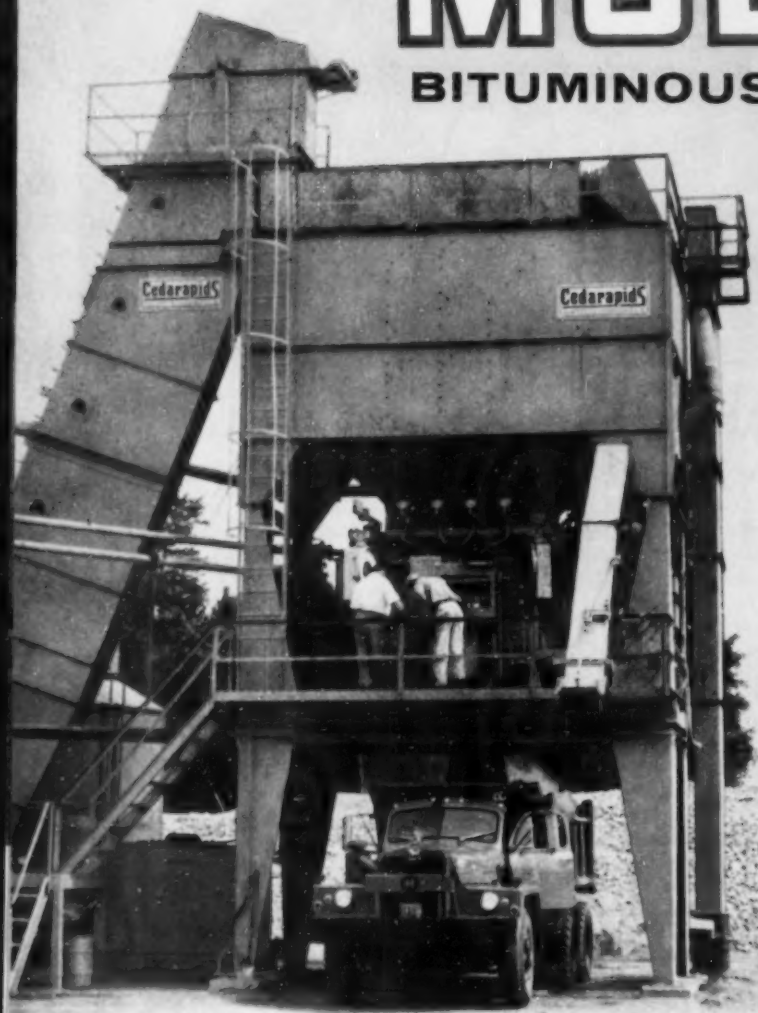
4 Final mixing with motor graders.

. . . to reduce hot-mix production costs still more!

Cedarapids announces a new line of

MODEL H

BITUMINOUS MIXING PLANTS



LOW INITIAL COST When 100% portability is unnecessary in your operations, a Cedarapids Model H Bituminous Mixing Plant is your best bet. These stack-up, batch-type plants are designed without running gear or self-erecting equipment to lower your initial investment and reduce maintenance.

SAME ADVANTAGES OF MODEL G PLANTS Except for portability, Model H Plants give you the same efficient features you'll find on Cedarapids Model G plants . . . high capacity (up to 200 tons per hour or more); all-automatic operation on the three larger models; maximum flexibility for meeting a wide range of specifications; rugged, low-maintenance design and construction.

MEETS EXACTING SPECIFICATIONS New Models H 60, H 50, and H 40 weigh, batch, mix, discharge and start a new cycle *automatically*, and the finished product of each cycle conforms to the most exacting specifications without variation. On Models H 20 and H 15, simple manual controls assure accurate weighing to meet strict specifications.

DESIGNED FOR PERMANENT OR SEMI-PERMANENT OPERATIONS Sectionalized units of Model H Plants can be quickly stacked up by crane for stationary installation. When necessary to move, the sectionalized units are easily transported by low-bed trailer.

FIVE SIZES to meet your volume demands

MODEL H 60	up to 7500-lb. batches* CAPACITY: 200 *plus* TPH
MODEL H 50	up to 5000-lb. batches* CAPACITY: 150 to 180 TPH
MODEL H 40	up to 4000-lb. batches* CAPACITY: 120 to 150 TPH
MODEL H 20	up to 2000-lb. batches* CAPACITY: 60 to 80 TPH
MODEL H 15	up to 1500-lb. batches* CAPACITY: 45 to 60 TPH

* depending upon weight of aggregate, drying conditions and job specifications.

■ You can't beat any Cedarapids Bituminous Mixing Plant for economical, profitable operation! But now, in keeping with the Cedarapids policy of offering *every* producer the kind of plant he needs to get the good contracts with low bids, Cedarapids offers a new, complete line of lower cost asphalt plants. The new Model H series plants retain all the efficient production features of the popular G 60 and G 40 models, yet reduce your initial investment to cut over-all production costs to rock-bottom levels. If your bituminous mixing operations call for permanent or semi-permanent installation, be sure to investigate the profit advantages of new Model H Plants. Ask your Cedarapid Dealer for details today.

IOWA MANUFACTURING COMPANY
Cedar Rapids, Iowa, U.S.A.

Cedarapids — Built by IOWA

Ad No. 458-N

BONDED BUY

an exclusive of your Caterpillar Dealer

BONDED BUY

You *know* what you're buying from your Caterpillar Dealer. On used Cat-built equipment he offers you a "Bonded Buy" backed by his Guarantee Bond up to $10,000—your assurance of satisfactory performance and guarantee of all parts.

Look for the "Bonded Buy" symbol—*your* guarantee of the best buy in used equipment.

Ask your Caterpillar Dealer about his "Certified Buy" and "Buy and Try" guarantees on used equipment, too. For the *safest* buy on the market, see your Caterpillar Dealer.

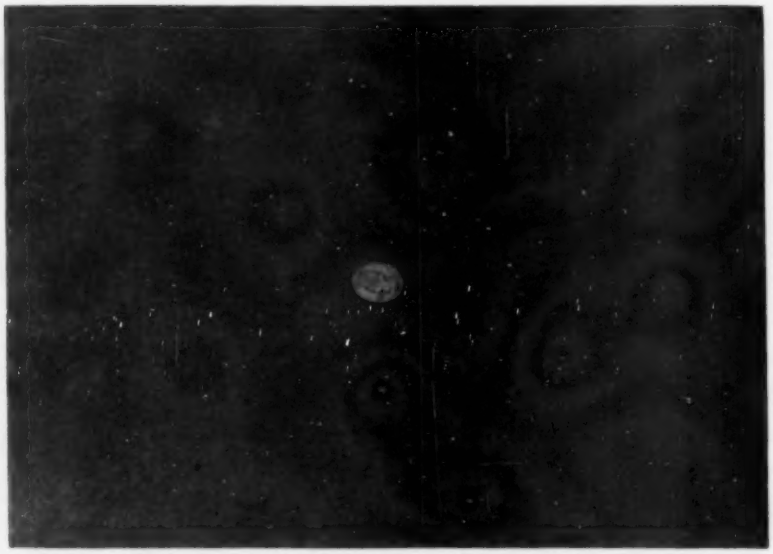
Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

BEST BUY IN NEW AND USED EQUIPMENT

For more details circle 254 on Enclosed Return Postal Card.



5 **Showing texture of finished base in comparison with 25 cent piece. Base had been down for several days and had gone through several hard rains.**

Rolling was performed by an 8-wheel rubber-tired unit pulled by a wheel-type tractor. Final shaping was by the motor grader. All equipment used was owned and operated by state highway maintenance forces.

Morton Salt Company's "Formula 10" is a material which has been properly screened and chemically treated to create the desired solution without too much water. The effect of this special formula sodium chloride arises from the properties it imparts to properly proportioned soil mixtures through water retention, crystallization, increase in surface tension, and physical chemical changes in the clay components. The plasticity of the clay components is maintained over a longer time, which prolongs the period during which compaction is taking place. This permits compression into a denser mass, with stronger and more lasting binding films than would otherwise be secured.

The preparation of base material, distribution of sodium chloride, final mixing, shaping and compaction were supervised by Morton Salt Company representatives. The project was sponsored by the state highway commission, fifth division, under Earl Crump, division engineer, and J. P. Brown, district engineer. A bituminous surface treatment was placed in fall, 1957.

"T-1" Steel Data

New guaranteed strength minimums for USS "T-1" steel, offering customer cost savings of up to 10 percent, are announced by U. S. Steel Corporation.

Higher yield and tensile strength minimums make possible the use of this low-carbon quenched and tempered construction alloy steel at higher design stresses. Use of the new minimums reduce by about 10 percent the fabricating, welding and shipping costs by using less material in all plates up to and including 2½ in. thick.

The minimum yield strength of "T-1" has been increased from 90,000 to 100,000 psi. The minimum tensile strength has been increased from 105,000 to 115,000 psi. The published tensile strength maximum of 135,000 psi remains unchanged.

The new strength data were arrived at after continuous tests on production lots at Homestead District Works of U.S. Steel. Developed by U.S. Steel after extensive research and experimentation, "T-1" is quenched and tempered on a special facility installed at Homestead about a year ago.

USS "T-1" steel has three times the yield strength and four times the atmospheric corrosion resistance of structural carbon steel. The material is reportedly adaptable for many highly successful mining, earthmoving, bridge, pressure vessel, industrial and construction uses.

PRO OF THE PUSHLOADERS:
THE MIGHTY D9

Unbeatable road building team by Caterpillar: DW21 Tractor with No. 470 LOWBOWL Scraper is pushloaded by D9 Tractor

When Ivan Dement, Inc., Amarillo, Texas, contracted to build an 11-mile farm-to-market road in Paloduro Canyon, they knew that the territory was rough and that they'd have to contend with heavy rock and extremely steep grades. But they also knew that their big yellow Caterpillar-built machines thrive on the *hard* work. "We have used Cat equipment for 16 years," comments Murray Gray, vice-president and general supt., "and think it's tops for long life and economy. We also like the service we get from our Caterpillar Dealer."

The D9 is the "big boy" of the Cat Diesel Tractor line. Put the power-packed D9 with 320 HP available at its flywheel behind the 25 cu. yd. heaped-rated DW21-No. 470 Scraper and you've got a road building team that is packed with profit-making power.

Power-boosted controls and excellent visibility make the giant D9 easy to operate. And it's available with torque converter or direct drive with oil clutch. See your Caterpillar Dealer. He'll show you actual performance records of this pro of the pushloaders and explain how it offers greater production at lower cost per yard. He'll give you a demonstration that will prove it on your job. Service? You'll get the best, as well as expertly made Cat parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

THE D9 PUSHLOADS BIGGER LOADS FASTER

LOOK FOR YOUR CATERPILLAR DEALER IN THE YELLOW PAGES

. . . for more details circle 251 on enclosed return postal card

FORD combustion chambers are fully machined for more efficient fuel use . . . longer engine life

Another reason why

FORD
Super Heavy Duty
INDUSTRIAL ENGINES
cut costs

Because they're *fully* machined to uniform size, combustion chambers in the new Ford Super Heavy Duty engines provide each cylinder with an equal volume of fuel-air mixture. This enables the Ford engine to develop greater power from every drop of fuel.

Machining also helps eliminate carbon deposits that cause hot spots and wasteful pre-ignition of fuel . . . gives you the most efficient engine your money can buy.

This is typical of the many engineering advances you'll find in Ford's full line of 4-, 6- and V-8 cylinder engines . . . ranging in displacement from 134 to 534 cubic inches. Included are two modern diesels—the Ford 220-cu. in. Diesel and the Ford 330-cu. in. Diesel. Most models are available as engine assemblies or complete power units, foot- or skid-mounted.

Whatever your application, Ford can power the job more *dependably* . . . and at *less cost*.

Ford
INDUSTRIAL ENGINES
AND POWER UNITS

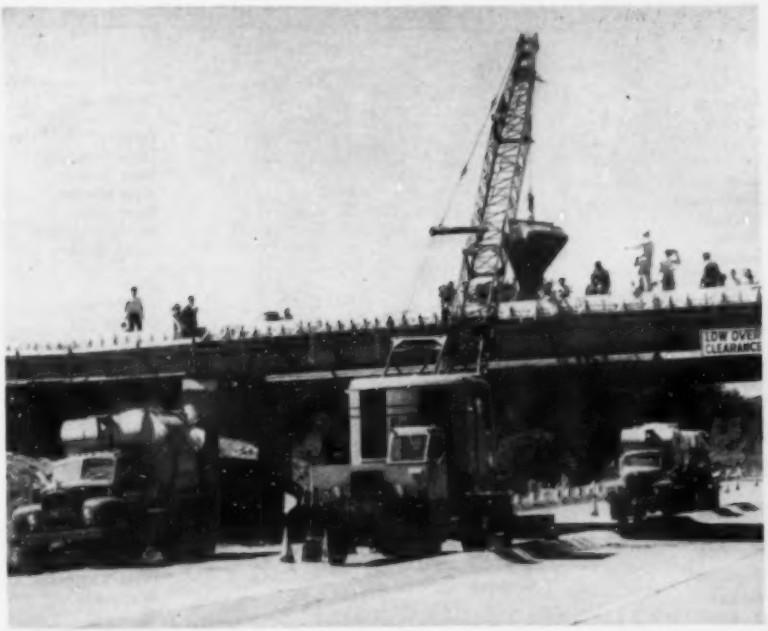
Write or phone today for complete information:

INDUSTRIAL ENGINE DEPARTMENT
FORD Division of FORD MOTOR COMPANY, P. O. BOX 598, DEARBORN, MICHIGAN

. . . for more details circle 267 on enclosed return postal card

Ready-Mix in The Highway Program

Second in a three-part round-up of this subject—as supplied by various state highway materials engineers in answer to an inquiry from the Roads and Streets' *editors.*



● **Ready-mix greatly simplifies the paving of many bridge decks. Shown here is an overpass deck being placed on the New York State Thruway, Berkshire section. Lane Construction Corporation, contractor. (*Roads and Streets* staff photo, summer, 1957)**

NORTH CAROLINA—*C. E. Proudley, State Materials Engineer:* This statement answering your questions are, due to lack of time to gather statistics, based chiefly on personal observation:

We have revised our procedures so that ready-mixed concrete is being used more extensively. It is the consensus that we have made the production and inspection of RMC much more exacting, and as a result are using this concrete in highway work with much greater confidence. For urban work RMC, either transit mixed or central mixed, transported in agitating or nonagitating bodies is used frequently.

One long job on the Interstate system has just been completed where non-agitating bodies were used from a central mixed plant and all concerned are well satisfied.

Our current state highway specifications do not cover all of the details. It has been necessary to apply those of ASTM and, more recently, AASHO plus some special requirements which we have felt necessary because of circumstances prevailing in North Carolina. The Ready Mixed Concrete industry in North Carolina has been almost 100 percent cooperative in the development of our control, and there have been comments from various sources to the effect that the last three or four years have seen a very decided improvement in the quality and service provided by RMC operators in general.

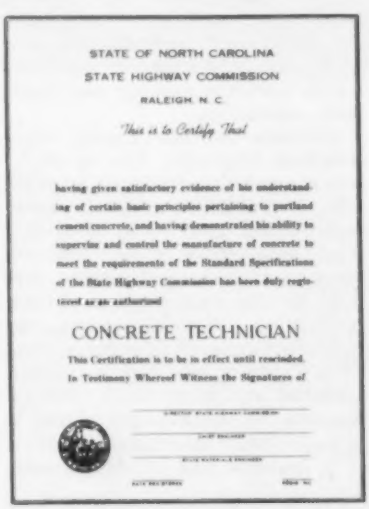
The special problem of inspection and testing come primarily from the shortage of qualified inspectors. It is our constant effort through various types of educational programs and schools to relieve the shortage and, although there has been some success, there is much still to be done.

A form has been devised (here reproduced) for certifying concrete inspectors. The individual receives this certificate and is registered only after he has satisfactorily completed a four-part examination (considered quite stiff by those who have seen it). This "exam" includes definitions, computations, design of mixes, performance of control tests and, finally, a demonstration at a ready-mixed concrete plant of the procedure he will follow when operating as a ready-mixed concrete plant technician.

South Dakota—Andrew W. Potter, Assistant Construction Engineer: Our specifications permit the use of ready-mix concrete for both structures and paving, and a section is written to control its use.

Ready-mix plants set up for commercial use are difficult to control. Coarse and fine aggregate piles must be tested and found to be satisfactory before use. Thus, to be certain that the aggregate piles used are satisfactory, they must be separated from those used for other sale. Constant change of mixes, when concrete is being furnished simultaneously for state and other construction from a ready-mix plant, adds to the confusion and likelihood of the wrong strength concrete being sent to a state project.

Inspection is difficult under such conditions and with the mix plant at times being a half-hour haul distance from the project poor mix



STATE OF NORTH CAROLINA
STATE HIGHWAY COMMISSION
RALEIGH, N. C.

This is to Certify That

having given satisfactory evidence of his understanding of certain basic principles pertaining to portland cement concrete, and having demonstrated his ability to supervise and control the manufacture of concrete to meet the requirements of the Standard Specifications of the State Highway Commission has been duly registered as an authorized

CONCRETE TECHNICIAN

This Certification is to be in effect until rescinded.
In Testimony Whereof Witness the Signatures of

● **Certificate given inspectors in North Carolina who pass rigid examination on ready-mix**

HOW THE STATE HIGHWAY DEPARTMENTS USE READY-MIXED CONCRETE IN PAVING

	NONE	MINOR	CONSIDERABLE (%)
Alabama	X		
Arizona	X		
Arkansas	X		
California	X		
Colorado			
Connecticut	X		
Delaware			X
Florida			
Georgia	X		
Idaho	X		
Illinois			15.4%
Indiana			
Iowa			
Kansas			
Kentucky			
Louisiana		X	
Maine	X		
Maryland		X	
Massachusetts			
Michigan		X—Used for driveway returns, curbs.	
Minnesota			
Mississippi		X—Turnouts & Crossings—1%	
Missouri			9.2%
Montana			
Nebraska		X—Used in Lincoln and Omaha	
Nevada			
New Hampshire			
New Jersey		X—Growing Trend	
New Mexico			
New York			
North Carolina		X (Less than 5%)	
North Dakota	X		
Ohio			15%
Oklahoma			
Oregon	X		
Pennsylvania		X—Trend to use in cities	
Rhode Island			10% (About)
South Carolina	X		
South Dakota		X—Limited to small pours	
Tennessee			20%
Texas	X		
Utah	X		
Vermont	X		
Virginia	X		
Washington		X	
West Virginia			
Wisconsin			
Wyoming		X	
Dist. of Columbia	X		

control often results. To provide a ready-mix plant inspector on small pours is almost prohibitive, when a few yards of concrete is needed on the job the order can easily be arranged by phone but to hold the work up until the inspector can travel to the plant site causes much delay. The problems do not exist where a stationary plant mixes concrete at the site and one Inspector with very little advance notice can watch both the mixing and placement operation.

Alabama—Marvin Taylor, Construction Engineer: Use of ready-mix concrete for structures is booming. Practically the whole state, both urban and rural, is within reach of a central plant. We continue to impose rigid quality controls for the state portion of such production. Notwithstanding, we still believe concrete paving, costing $4 to $5 per sq. yd., with its modern additives and strict batch controls, deserves the entire output of one or more pavers, with concrete supplied at a uniform rate of delivery—all day.

When numerous customers are being supplied from the same mixing plant, inspection and testing problems are many. For structure concrete going into State and Federal work, we test all aggregates and accept state verified mill tests covering all cement used at the plant. We feel that concreting operations have reached a fair degree of perfection, but still lack enough to demand all traditional inspection procedures, if for no other reason than a record.

Arizona—W. G. O'Harra, Engineer of Materials: While there are differences in the inspection and testing caused by the use of transit mixers, these differences are usually minor in nature. Probably the chief problem is the lack of contact between the batching plant and the work at the job site, making it difficult to make any adjustments deemed necessary at the site.

The time involved in hauling is also somewhat of a problem in this climate, as the extremely hot days in the summertime require shorter haul periods than ordinarily would be permitted.

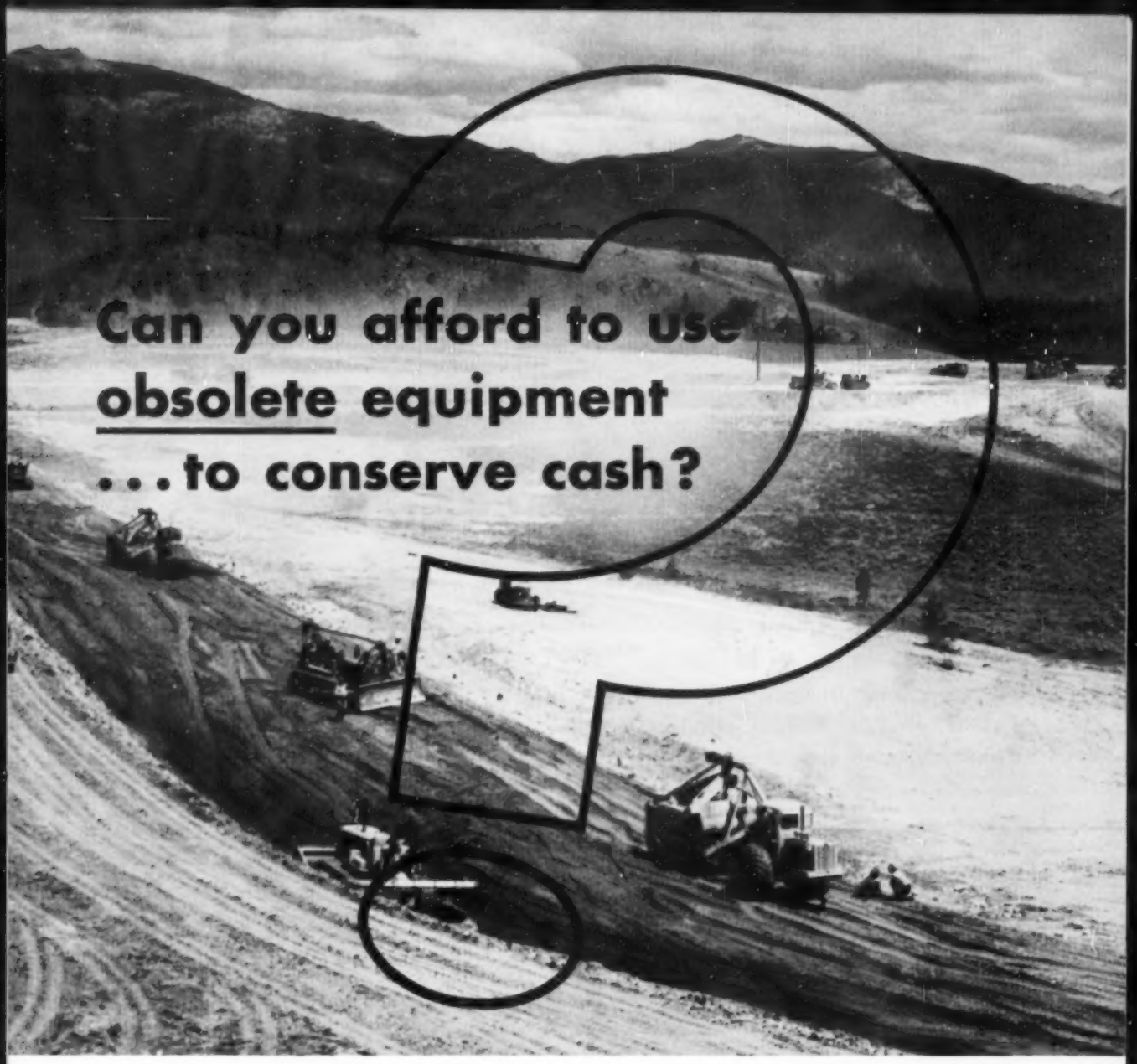
New Jersey—Neil MacDougall, Chief Engineer, Division of Planning, Research, Soils and Tests: Some phases of this type of concrete, of course, do cause us concern. When it is considered that each transit-mix truck driver becomes a mixer operator, rigid inspection becomes a problem. However, it only takes one rejection of a mixer load to impress a driver that we will not tolerate concrete with too much or too little water added.

AGC Movie Released to Aid Industry Recruitment

"The Constructors," a color motion picture highlighting the industry's need for engineers, has been produced by The Associated General Contractors of America.

Designed to interest students of junior and senior high school age in engineering, while young enough to take proper preparatory courses, the 17-minute, 16 mm film also is being used by AGC chapters to promote interest in construction among civic, veteran and union groups.

The film is being made available through AGC chapters and branches. Information may be obtained from these AGC chapters or national headquarters in Washington, D.C.



When you split your fleet into working units, do you have uniform, top-production efficiency from each unit? . . . or do you have a few slow-moving tractors and scrapers that can't keep pace with your newer machines? Do you know what these production lags cost you in yardage . . . and profits?

When skies clear after a bad-weather break, and you line up your fleet to move pay-dirt, do your "old-timers" fail to deliver just when you need them most? Have you figured how much this costs in lost yardage? . . . in idle manpower? . . . in shrinking profits?

Every production tool has its "point-of-no-return." When it becomes subject to frequent repair . . . or if its speed is too slow to keep up with companion equipment . . . it is time to check its earning value. It is time, in fact, to trade it in on a new, fast, higher-production tool that can cut your costs. And *now* is a good time to trade. Use your old machine for down payment. The increased production from a new machine, added to your savings in repair of an old machine, can quickly retire the obligation . . . help to conserve cash . . . increase your profit margin.

Why not see your nearby LeTourneau-Westinghouse Distributor . . . get from him the latest facts on how fast, modern L-W equipment will soon pay for itself on your spread. It is possible that you may not even have to disturb your cash reserve in order to capitalize on bigger future profits. Certainly, it will cost you nothing to find out!

Please turn the page . . .

Top trade-in

...at your LeTourneau-

To move big yardages, fast...

335-hp, 31.7-mph B Tournapull®

with 27-yd Fullpak® Scraper

Low, wide bowl loads faster... boils better... fills all corners ... heaps low-void payloads. Electric controls assure top operating efficiency in any weather, minimize downtime and maintenance. Electric power-steer makes 90° turns, enables big machines to "duck-walk" out of muck and mud, and work in narrow places. L-W power-transfer differential helps keep traction on solid footing, prevents stall, maintains steady speed in toughest working conditions. Available with 335-hp Cummins diesel and Allison torque converter, or choice of 300-hp Cummins or GM diesels with step-gear transmission. *Ask for a demonstration!*

"Standard of the industry"

210-hp, 29.9-mph C Tournapull

with 18-yd Fullpak Scraper

The original C Tournapull introduced the 2-wheel prime-mover, and revolutionized earthmoving. Since those pioneer days, the C 'Pull' has been constantly improved. It is still the standard by which all other scrapers are compared. Today's 18-yard "C" is big enough to work profitably on big production, yet its ownership-operating cost is so low you can use it to advantage on one-man jobs. Available with 210-hp GM or 200-hp Cummins diesel engines, with step-gear transmission, or optional L-W power-shift torque converter. Dependable electric controls. *Trade in an old scraper on a new "C". Ask for a demonstration!*

Load biggest scrapers in seconds

with 420-hp, L-W Twin-C† Tractor

...cut costly tandem pushing

Want to load your biggest scrapers, *fast*... at *less cost*? Twin-C, with its 40 tons tractive weight, 4-wheel synchronized drive, and power-transfer differentials, develops 64,500 lb drawbar pull, attains forward speeds to 20 mph. It eliminates the need for tandem pushers, gives you the economy of one-man machine operation. With electric-steer, it maneuvers fast, makes 60° turns right or left, lines up quickly for direct push. Big, wide-base tires "hang-on" in soft footing, up steep grades. If you operate *big* scrapers, get the facts on how this powerful Twin-C tractor can help boost production and increase your profits!

Speed-up your tractor work...

fast, 210-hp C Tournatractor®

can save you time and money!

On work where wide travel range is important... leveling scattered fill, towing compactors and "part-time" scrapers, cutting drainage ditches, stockpiling, maintaining haul roads, push-loading, doing dozens of chores over a wide work area... Tournatractor can save you time and money. And it travels job-to-job at speeds to 17.2 mph, over highways and cross-country, without the aid of truck-and-trailer. It will pay you to balance your tractor fleet. Use your big crawlers on short-haul pushing and dozing... use fast, rubber-tired C Tournatractor for scattered odd-job assignments, clean-up, and finishing. *Ask for demonstration!*

values NOW

Westinghouse Distributor...

Your old machines *will never be worth more* than they are today! And they may be costing you money in repairs and availability. The extra production you can get with new machines — every hour, every day — can mean more favorable bids, steadier work, lower maintenance, higher profits. To get most for your money, invest *now* in the modern, efficient L-W equipment shown here.

Cut costs on scattered jobs
with "Handyman" D Tournapull
...138 hp, 29.5 mph, 9-yd capacity

Fleet owners find this multi-purpose "D" profitable for odd jobs and close-quarter work, where big machines waste time and run up costs. Works alone or in fleets, self-loads or can be push-loaded. Makes 180° turns in 24'3" . . . eliminates need for turn-around areas. "D" is used universally for clean-up, for building driveways, leveling home sites, terracing, ditching, completing many types of small contracts. Powered by 138-hp GM diesel, with step-gear transmission and power-transfer differential. Instant, electric controls. Roadable anywhere without permit. Now is a good time to talk "deal" on a "D". *Ask for demonstration!*

For low-cost, off-road hauling
. . . L-W Tournapull Rear-Dumps
in 11, 22, and 35-ton capacities

Wide bowl, low rear-entry, makes loading easier, *faster*. Machines make continuous U-turns in less space than their own length . . . in about ⅔ their length when in dump position. This saves time positioning at shovel . . . makes it possible to work in tight quarters. Machine dumps clear over banks . . . eliminates dozer clean-up . . . pulls away from edges safely, with front drive-wheels always on firm footing. Frameless construction eliminates most ordinary trouble spots . . . reduces maintenance. Rear-Dumps easily interchange with scraper units behind Tournapull prime-movers. *Get full details!*

† Trademark

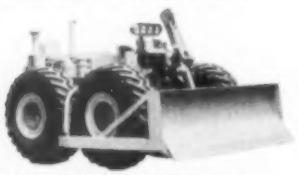
Match power to load with
7 sizes L-W Adams† graders
. . . do more work per $ invested!

Select the *right* grader for your particular need from this most complete range of sizes: Biggest in line is L-W POWER-Flow® 660; 190 hp with torque converter, infinite speeds to 27.4 mph. Second in size is the "660"; 160 hp, 8 forward speeds to 26 mph. Next, the POWER-Flow 550; 135 hp with torque converter, infinite speeds to 25.8 mph. Three medium sizes: "550", "440", and "330" — 123, 115, and 80 hp — all with constant-mesh transmission, 8 forward speeds to 25 mph. The utility model "220" provides 60 hp, 5 speeds to 18.3 mph. *(Creeper speeds optional on all gear-shift models.) Ask for demonstration!*

Please turn the page . . .

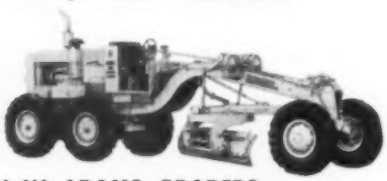
TOURNAPULLS (27, 18, 9 cu yd)

REAR-DUMPS (35, 22, 11 tons)



210-hp TOURNATRACTOR

420-hp TWIN-C TRACTOR



L-W ADAMS GRADERS
(190, 160, 135, 123, 115, 80, 60 hp)

To conserve cash reserve ...make sure you get greatest earning capacity for your machinery money

Great improvements have taken place during the past few months in the pace-setting line of LeTourneau-Westinghouse earthmoving tools. Wider selection, bigger capacities, greater speed, lower up-keep ... advantages engineered to help you cut costs and UP your profit margin. So many advantages, in fact, that we believe the only way we can do them justice is by actual demonstration.

Fill out and mail "request for demonstration"

Address it to your nearest LeTourneau-Westinghouse Distributor, or send it to the factory and it will be forwarded to the L-W Distributor best situated to give you prompt service. *You will be under no obligation, so do it now!*

MAIL TODAY!

Request for demonstration

(Mail to your LeTourneau-Westinghouse Distributor or to factory at Peoria, Ill.)

Gentlemen: Please make arrangement to demonstrate for us the machines checked here. We may need tools of this size on or about (date).....

Tournapulls: ☐ B ☐ C ☐ D
Rear-Dumps: ☐ 35 ☐ 22 ☐ 11
(tons capacity)
☐ C Tournatractor ☐ Twin-C Tractor

Motor Graders:
POWER-Flow ☐ 660 ☐ 550
Constant-Mesh ☐ 660 ☐ 550
☐ 440 ☐ 330
☐ 220 Sliding Gear

NAME .....

TITLE .....

FIRM .....

ADDRESS .....

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STATE or PROV.....

PHONE .....

(It is understood that we are under no obligation.)

Litho in U.S.A. LA-1621-DC-4

"Get-ahead" with the years-ahead L-W line

LeTourneau-Westinghouse originated the two-wheel, electrically-controlled, rubber-tired prime-mover ... and was first to introduce a rubber-tired, heavy-duty tractor. More than 12,500 of these machines, working in all kinds of conditions in all parts of the world, have established unequalled records for dependability and low-cost production. Same is true of the pioneer Adams line of motor graders, up-graded in recent years by L-W research and engineering. So, "get-ahead" with "years-ahead" L-W machines ... improved constantly for your benefit.

Before you buy your next earthmoving machine, see your L-W Distributor. Get his answers on *what machines* work best, on *which jobs*, at *lowest-net-cost* to you. You can depend upon straight answers! He wants to merit your confidence.

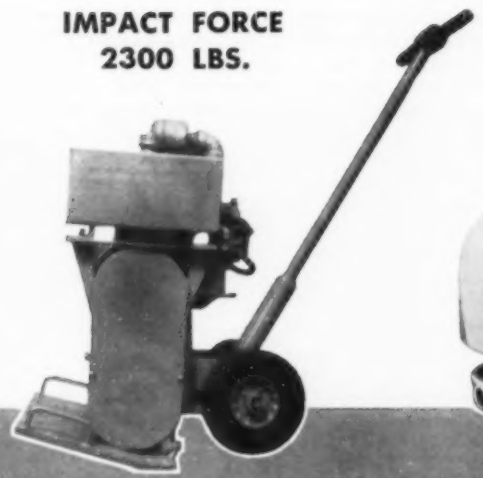
LETOURNEAU-WESTINGHOUSE COMPANY
Peoria, Illinois
A Subsidiary of Westinghouse Air Brake Company
"Where quality is a habit"

Are You Having Compaction Problems?

BACKFILL SINKING? SLABS CRACKING?

. . . Eliminate with a Terrapac Vibratory Compactor!

IMPACT FORCE 2300 LBS.



TERRAPAC CM-15

IMPACT FORCE 3-1/3 TONS

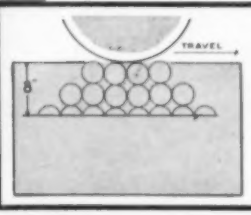
TERRAPAC CM-20

Small, self-propelled, one-man operated, heavy-duty vibratory tampers now enable you to really compact crushed stone, sand, gravel, etc. without bringing in 10-20 ton static rollers. . . . They are also ideal for small asphalt jobs including patch work. . . . The CM-15 will compact lifts up to 12 inches, while the CM-20 penetrates up to 30 inches — in one or two passes. . . . Prove it to yourself — on your own job. . . . To arrange a demonstration, contact your local Vibro-Plus distributor or write to us direct.

Ad 41-57

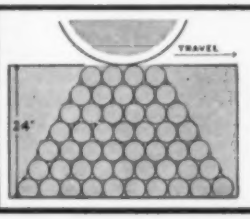
SPECIFICATIONS

	Impact	Frequency VPM	Travel Speed	Weight
CM-15	2300 lbs.	2350	up to 55′ per min.	242 lbs.
CM-20	6600 lbs.	2000	up to 75′ per min.	950 lbs.



CONVENTIONAL STATIC COMPACTION

Static rollers, relying on weight alone, produce friction forces between soil particles causing bridges to form. Terrapacs break bridges for deep compaction.



TERRAPAC DYNAMIC COMPACTION

Vibratory energy breaks frictional forces binding soil particles together, allows soil to sift down producing uniform densities at greater depths.

VIBRO-PLUS VB TERRAPAC

VIBRO-PLUS PRODUCTS, Inc.

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How to Choose Hardsurfacing Materials

(Abridged from a paper presented by D. B. Rankin, Rankin Manufacturing Company, American Welding Society Session, 10th Western Metal Congress, Los Angeles, California)

NOW FOR A NUMBER of years, research men have been attempting to devise a laboratory test which would accurately determine the relative wearing qualities of different metal surfaces under all conceivable operating conditions. Many and varied testing machines have been built, and their accuracy subjected to quite intensive examination. To date not one has been universally accepted.

During the course of these investigations, however, a number of interesting and somewhat unexpected discoveries were made. To mention one of these, it was found that a metal surface "A" may last considerably longer than metal surface "B" under one set of abrasive conditions. But the exact reverse may be found to hold when conditions are substantially altered.

This exploratory work by the testing men has not been in vain. We have learned a great deal wearwise about alloying combinations. These discoveries have gone far toward constantly improving products in the hard-surfacing industry, as well as suggesting more effective ways of applying these products.

• *Field Testing Only Way.* At the present time, the only reliable way to determine how well a hard-surfacing rod is going to do a job—or how much superior or inferior it is to some other rod—is to perform actual tests in the field.

Only the rods from each manufacturer's line which are best suited to do the job should be tested against those from competitive lines. There are two ways of ascertaining which of any manufacturer's products best qualify to meet the conditions in mind.

Most producers have published lists showing which of their various surfacing alloys are best suited for various applications. One way is to take these recommendations at their face value, and proceed to test the one recommended. This is by far the most popular method. It is the safest.

Often, however, the problem is not this simple; sometimes two or more rods from a given line are indicated for certain applications. The main reason for this is that many users may be operating the same piece of equipment under such radically diverse conditions.

To illustrate what we mean, most sets of crushing rolls remain in service for several weeks or months, but in some isolated instances, wear is so drastic that they will not perform efficiently for one whole shift or full number of shifts. In a case like this a lower-priced material, although cheaper to apply, will not be nearly as economical to use as a more costly material that will stand up to eliminate mid-shift shutdowns for maintenance purposes.

Such factors call for serious study of the particular problem at hand. In many cases, two or more members of the same family should be tested against each other, to determine which one should be compared with competitors.

• *Correct Application* Techniques. The second important consideration in field testing has to do with correct application techniques. "Important" is hardly a strong enough adjective here, since the wearing properties of hard-surfacing deposits have been found to be so tremendously affected by different application procedures.

In fact, the difference between the service obtained by applying the same material with different procedures, will often far exceed the differences between quite unlike alloys applied the same way.

Here again, the manufacturer should be able to indicate in a general way which procedure will give the best results with each of his products. But it still must remain with the user to determine for himself which is the over-all economic method.

The first of possible welding variables is the *polarity* setting of the welding machine itself. Where a rod will only perform correctly on one of the two possible polarity settings, that setting of course is the one that must be used. If the electrode runs on either polarity, straight will give faster deposition rate, less dilution from parent metal, and higher build-ups; all of which are generally desirable. On the other hand, most bi-polarity rods operate much more smoothly on reverse polarity. And when a relatively thin, smooth deposit with an assured sound strong bond is desired, reverse polarity is the one to use.

• *The Ampere Setting.* The next variable is the *ampere* or *heat setting* of the welding machine. Higher ampere settings will give faster deposition rates. At the same time, they introduce appreciably more heat into the parent metal and result in more dilution of the overlay with this metal. Higher deposition rate, we fear, is too often the prime concern of many welders. And often where high amperages are employed, excessive dilution from parent metal will result in a surface whose composition is so different from that conceived by the manufacturer that its wearing characteristics will be nearly completely destroyed.

A few hard rods give deposits that are definitely superior when cooled as slowly as is practically possible. For these, high ampere settings and reverse polarity are generally preferable.

However, in most cases, the parent metal is left in a much more desirable condition when not overheated. This is true particularly if it is the widely-used manganese steel, which is greatly harmed by exposure to high temperatures. And nearly all hard-facing overlays benefit in direct proportion to the cooling speed. Rather astonishing as it may seem, a case is on record where the wearing life of a surface was actually tripled by applying it with 50 amperes less heat.

• *Deposition Time* Secondary. This brings us back for a moment to the subject of *deposition* rate and the objection that operating at lower amperes "takes too long to do the job."

In order to persuade welders to

(Continued on page 86)

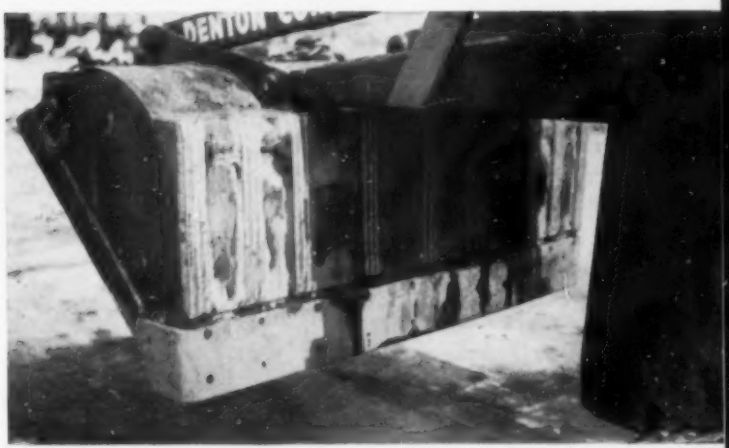
Hardfacing time—"Whenever the Welders Can Catch the Machines Not Working"

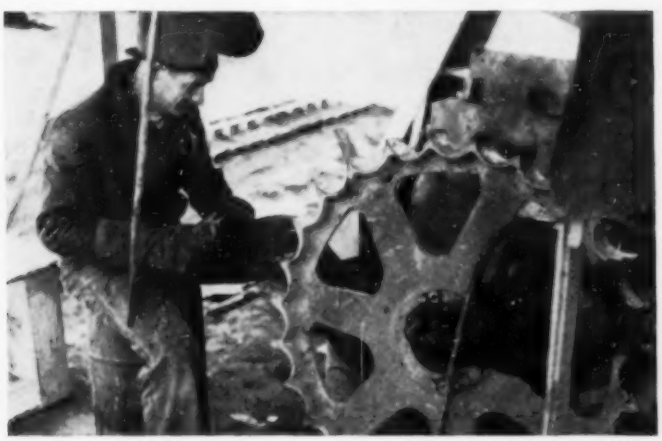
Examples of hardfacing of buckets, teeth, and other areas subject to severe abrasion, as photographed by the Roads and Streets editors.

● On Oregon road job—good example of building up and armoring of shovel tipper teeth, sockets and side plate—result: added months of useful life.

● (Above, Right and Below): Pictures snapped in a field shop of Geo. M. Brewster & Sons Co., of Bogota, New Jersey. Sprockets, tractor track rollers and other parts built up with hardfacing materials, as part of field overhauls.

● (Below): Loader bucket—beads of hardfacing metal welded on bottom plate, to provide abrasion resistance during sliding over granular materials during loading operations. Denton Construction Co., Detroit paving contractor.

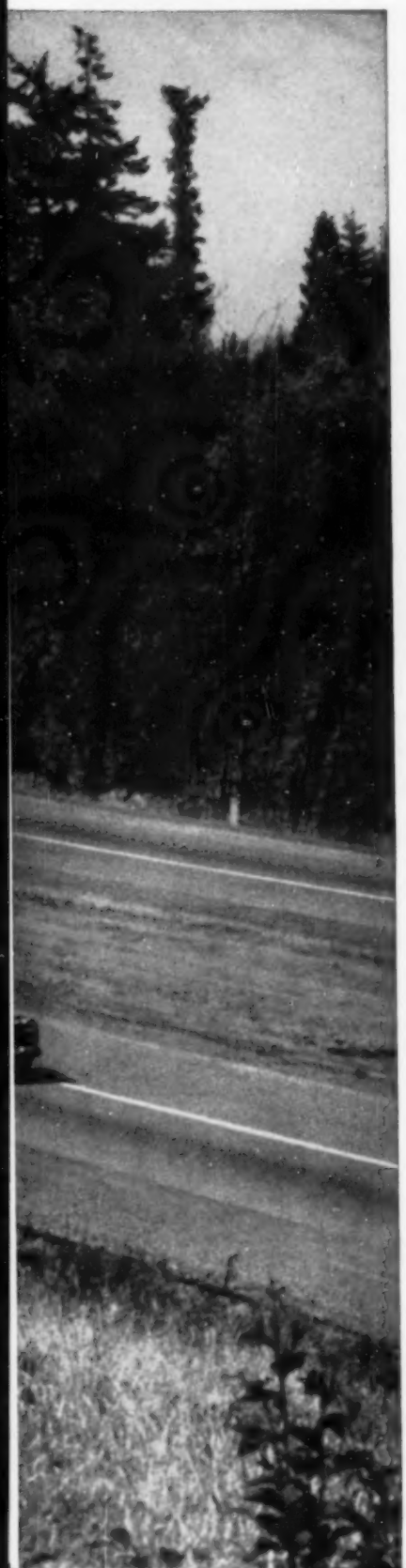




Rugged ASPHALT paving saves

Ribbons of velvet smoothness . . .
MODERN **ASPHALT** HIGHWAYS

Washington $30,000 a mile



...Saves State $381,000 in first cost on 12.7 miles of Interstate Highway. Maintenance savings expected, too!

For the Prairie Creek to Tumwater section of U. S. Highway 99, the State of Washington chose modern Asphalt pavement.

By so doing it saved thousands of dollars in initial costs alone. The entire paving cost for 12.7 miles was $826,978 . . . with savings of $30,000 a mile compared with a connecting slab-paved section. *And more savings are to come . . . for Washington's records indicate that Asphalt pavements cost less to maintain.*

As records show in state after state, modern Asphalt highways are not only economical but also rugged and safe.

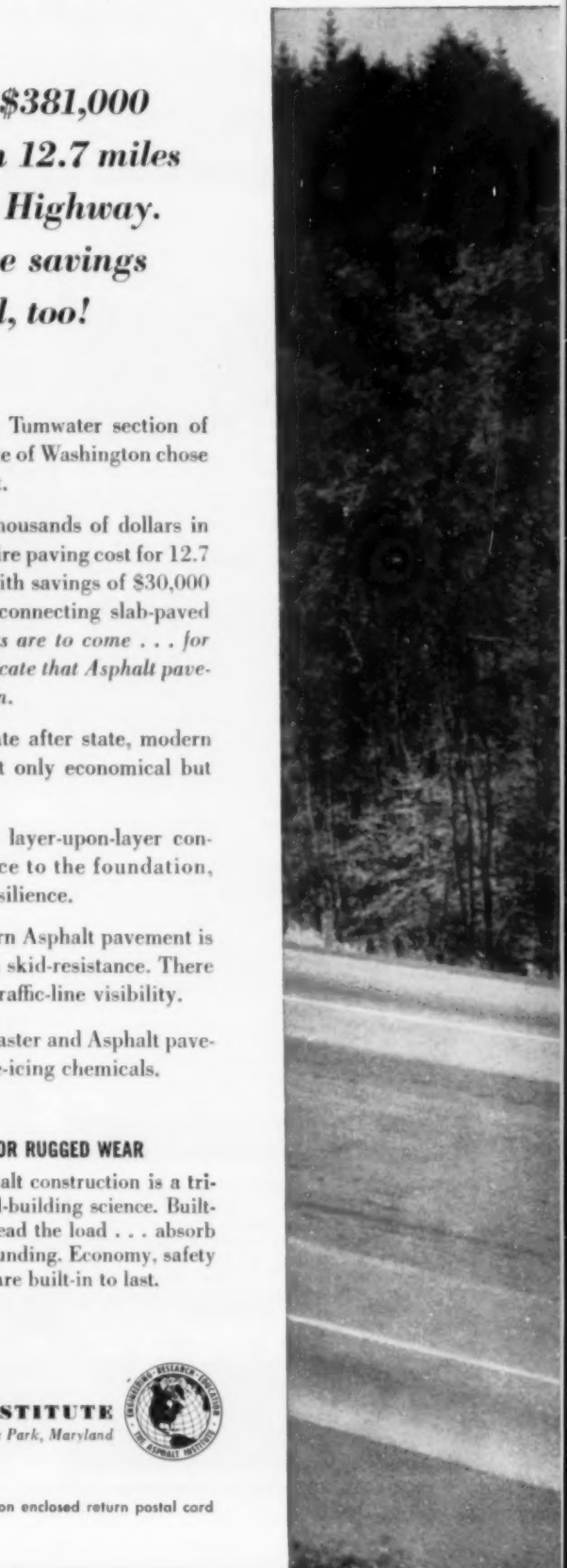
Rugged . . . because layer-upon-layer construction "locks" surface to the foundation, builds up strength and resilience.

Safe. . . because modern Asphalt pavement is traction-textured for high skid-resistance. There is less glare . . . greater traffic-line visibility.

In winter, snow melts faster and Asphalt pavement is not harmed by de-icing chemicals.

ENGINEERED FOR RUGGED WEAR

Modern Asphalt construction is a triumph of road-building science. Built-up layers spread the load . . . absorb shock and pounding. Economy, safety and comfort are built-in to last.



THE ASPHALT INSTITUTE
Asphalt Institute Building, College Park, Maryland

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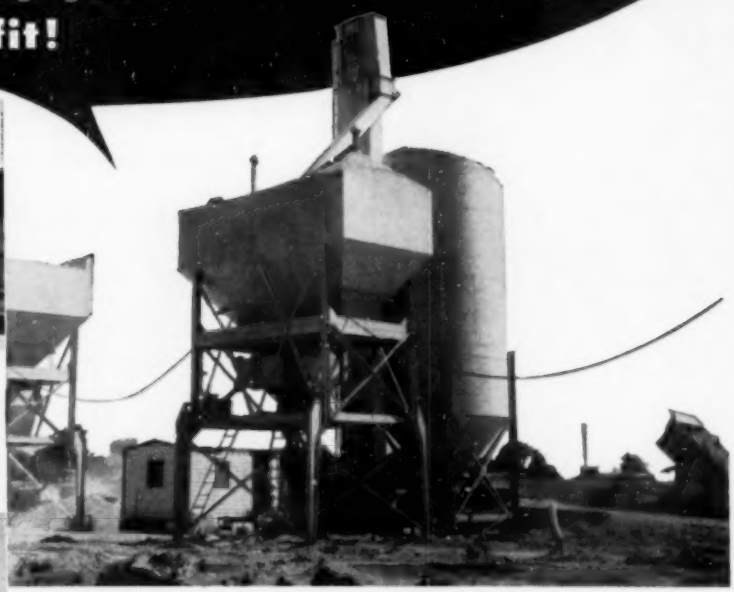
If you moved your ROADBUILDERS PLANT only ONCE . . . the BUTLER TX-4 would still pay you a Bigger Profit!

Bin section is complete, ships and erects with bracing members in one piece. Rests on top of batchers. . . .Batcher section also has its own permanent bracing for transport and erection as a unit. Moreover all piping and wiring are in-place. Quick connectors for air and electricity make hook-up a matter of minutes.



Support columns are hinged to batcher section, swing into place as batchers are raised. . . . Elevator ships in two pieces with chain and buckets installed. Cement overflow bin ships complete with support columns attached.

WORLD'S RECORDS IN BATCHING SPEEDS

Production has actually been maintained at a 15 second cycle with the TX-4. But 20 seconds is more practical for figuring costs if you can spot your trucks at such a rate. Depending on the number of batchers in your TX-4 plant this means 6, 9 or 12 batches every minute. That's a world's record in production — and in profits.

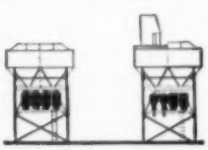
• Send for this Bulletin describing the TX-4 in great detail. The whole story is there. You should have it for the BUTLER TX-4 obsoletes every other plant now in existence.

. . . And the oftener you move the more you'll appreciate the unparalleled portability of the TX-4

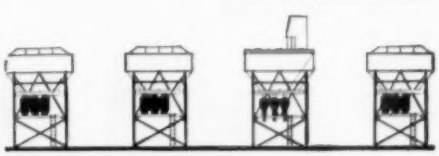
The BUTLER TX-4 Roadbuilders Plant is dismantled and erected in such a small fraction of the time required by other set-ups that you'll pocket an *extra* profit by the saving.

Start with a One Paver set-up . . . Expand Your TX-4 as you grow

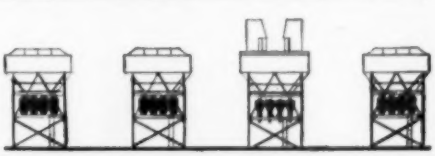
Let's assume that you are batching for one or two dual drum pavers. You start with the basic plant — two TX-4 bins, one compartmented for cement and sand, the other for two sizes of stone.



For 3 pavers simply add two more bins with batchers as shown.



And for four dual drum pavers, just add a batcher to each of the four bins.



BUTLER BIN COMPANY

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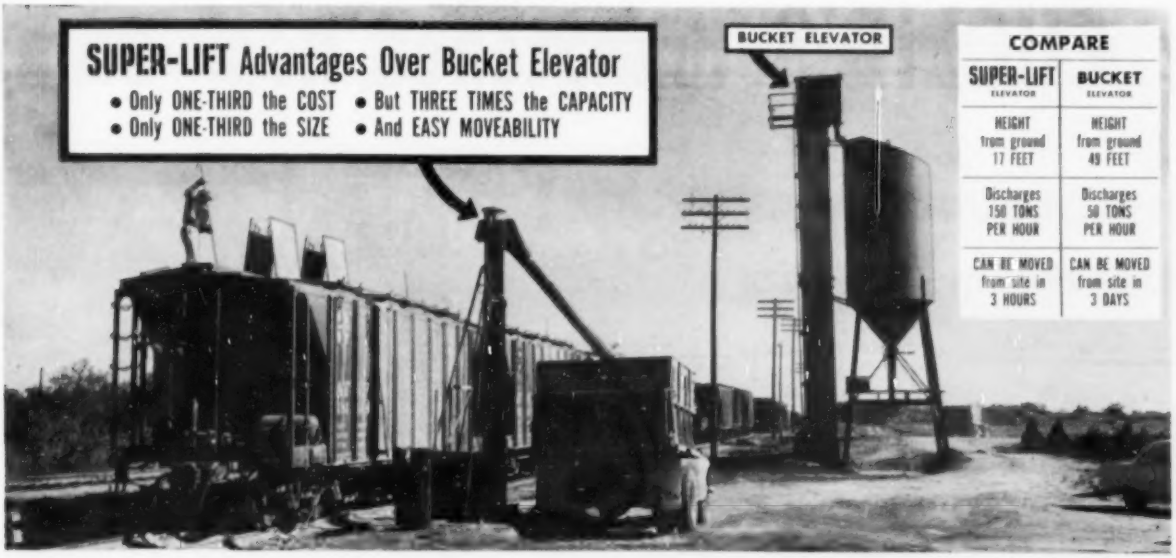
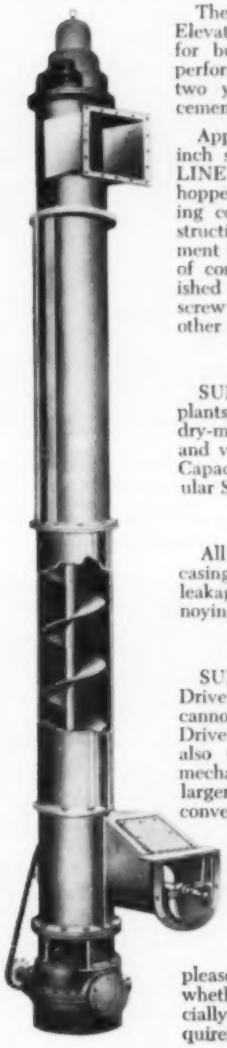

SUPER-LIFT Advantages Over Bucket Elevator
• Only ONE-THIRD the COST • But THREE TIMES the CAPACITY
• Only ONE-THIRD the SIZE • And EASY MOVEABILITY
BUCKET ELEVATOR
COMPARE
SUPER-LIFT ELEVATOR
BUCKET ELEVATOR
HEIGHT from ground 17 FEET
HEIGHT from ground 49 FEET
Discharges 150 TONS PER HOUR
Discharges 50 TONS PER HOUR
CAN BE MOVED from site in 3 HOURS
CAN BE MOVED from site in 3 DAYS

Now . . . a New Screw Elevator for Bulk Cement!



The new Fort Worth SUPER-LIFT Screw Elevator brings you major new advantages for bulk cement handling. SUPER-LIFT's performance and ruggedness are proved by two years of actual use in a variety of cement-handling operations.

Applications include the one above—a 12-inch screw elevator (fed by 12-inch BEE-LINE Screw Conveyor extending under hopper car) loading cement in trucks serving concrete mixers for new turnpike construction. This single elevator handled cement for most of the half-million cubic yards of concrete used in the project. When finished here, the contractor easily moved the screw elevator and put it to work in another state.

VARIED APPLICATIONS

SUPER-LIFTS are at work in batching plants (both fixed and portable), ready-mix, dry-mix, block, and cement-storage plants, and varied handling set-ups in construction. Capacity and horsepower figures for popular SUPER-LIFT sizes are at right.

DUST-TIGHT

All joints and seams in SUPER-LIFT'S casing have special seals to prevent cement leakage. You save cement and eliminate annoying dust problems.

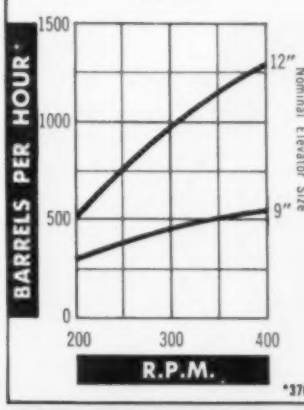
OIL-TIGHT—GREASE-TIGHT

SUPER-LIFT's unique DSD (Dry Shaft Drive; Patent Pending) means lubricant cannot leak from DSD Thrust Head or Drive Unit and contaminate cement—and also that cement cannot filter into these mechanisms. The DSD Thrust Head has larger bearings and is more rugged than conventional thrusts—permitting higher elevator speeds and greater operating efficiency. Drive units are available for either top or bottom mounting.

For more data on SUPER-LIFT'S new advantages for your cement handling, contact FORT WORTH. Our application engineers will be pleased to recommend for your need—whether a single elevator or a system specially-engineered for your particular requirements.

FORT WORTH
SUPER-LIFT
SCREW ELEVATOR
with D.S.D. *Dry Shaft Drive Patent Pending

Lifting Bulk Cement with SUPER-LIFT



HORSEPOWER REQUIRED

BARRELS PER HOUR*	20 FT. LIFT	40 FT. LIFT	60 FT. LIFT
250	4.9	8.9	12.9
500	8.4	15.7	23.0
750	11.3	21.3	31.3
1000	14.2	26.9	39.6
1250	17.5	33.3	49.0

*376-LB. BARRELS

FORT WORTH
STEEL AND MACHINERY COMPANY
Serving Modern Industry Since 1917

3600 McCART STREET FORT WORTH, TEXAS

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EUCLID'S unmatched Rear-Dump

Over 400 Euclid Rear-Dumps were put to work on the U. S. side of the St. Lawrence Seaway—with many others on the Canadian side. The 22-ton "Euc" outnumbered all other makes and models of off-highway haulers on this huge earthmoving project.

On the Iron Ranges almost 4 times as much ore is moved in "Eucs" as in all other make Rear-Dumps! In Minnesota alone more than 1300 Euclids of 15 to 50 ton capacity are hauling ore and overburden.

Dam construction demands equipment that can take the pounding of heavy excavation loaded by big shovels and draglines and keep coming back for more! "Eucs" are unequalled for job availability and for low cost production—that's why they've been the choice of dam builders for many years.

Rear-Dump "Eucs" have proved their rugged dependability and outstanding performance on the toughest jobs. With engines of 143 to a total of 670 h.p., they have plenty of power to move big loads on steep grades and difficult hauls often encountered in highway work.

With capacities ranging from 10 to 50 tons, there's a Rear-Dump "Euc" to fit any quarry or open pit mining operation. Simple design, combined with ample power and speed, easy handling and minimum downtime results in more tonnage moved at lowest cost. Quarry body is optional on most models.

experience gives you Bonus Benefits

For 25 years Euclid has specialized in designing and building equipment for heavy, off-highway earthmoving. The dependable low cost performance of these "Eucs" has made them the standard of comparison for contractors, mines and quarries around the world. About 7 of every 10 off-highway Rear-Dumps are Euclids.

Although this unmatched experience may not be apparent when comparing specifications, it assures bonus benefits for Euclid owners—cost-cutting advantages not provided by comparable equipment. The greater use of Euclids results in faster complete field exposure to operating and maintenance characteristics under all conditions. It assures advanced design that pays off in more work-ability and minimum downtime on the job.

With Euclid's larger machine population, it's economically possible for Euclid dealers to provide more complete service facilities and ready availability of all factory engineered replacement parts. It's factors like these that enable owners to keep their "Eucs" operating at peak efficiency with unusually high availability and low production cost.

When you're considering Rear-Dumps, get facts and figures from your Euclid dealer—have him show you why ***Euclids are your best investment.***

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Your Euclid Dealer offers
the best equipment investment

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GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

HARDSURFACING MATERIALS

(Continued from page 79)

check whether they can greatly improve hard-surfacing by depositing at reduced amperages, let us consider the following figures.

By actual measurement, a 3/16-in. rod, operating at 175 amps, required 62 seconds to be consumed. An identical stick pulling 125 amps took 76 seconds to burn off. This represents a difference of 14 seconds per stick, or 1.6 minutes to the pound.

To determine what this means in an actual (although somewhat exaggerated) case, let us take, for example, a hard-facing job done on a set of roll shells, where perhaps 100 lb. of the material is being applied. If we were operating at the lower amperage, we would increase the welding time to do this job by 160 minutes or two and one-third hours. We believe all will agree that this increase in application time becomes most inconsequential if the life of the shell is increased from a month to three months, or to two months or even six weeks. Not only is down-time drastically reduced, but so are the actual welding costs themselves.

As another illustration, consider a case where a set of four shovel teeth are being hard-surfaced. The quantity of rod required to do such a job as this is usually about 6 lb. At the low amperage, only 10 minutes more would be needed to face these teeth. If they last any discernible time longer, this would certainly be the amperage to use.

• *Value of Double Pass.* There are a number of other variables possible, but the only one that we shall now mention is the generally highly beneficial results of applying a double pass of rod to a surface. On the obvious face of it, this doubles the cost of operation and in some cases results in a higher build-up than is desired and in isolated instances, might set up undesirable strains in the parent metal. However, here again, startling results have been obtained by multipassing and it is not exaggerating too much to say that a double pass surface can last three or even four times as long as a single pass would. We do not contend that this is always the case, but we know of no place where it has not run twice as long as a single pass and so certainly no harm can come from trying it.

• *Quantity Applied.* The next consideration in field evaluating hard rods is the *actual quantity applied,* and the over-all cost of applying. Of course, it is desirable for comparison that identical quanties be applied to their relative surfaces. This does not necessarily mean that identical quantities should be used in actual service, because some rods have a much higher recovery rate and it takes less of them to do a given job that it does of some with higher welding losses. The ultimate aim in testing should be to cover each of the surfaces in question to the same thickness.

• *In Conclusion:* (1) It is impossible to conduct wear resistant tests in the laboratory. (2) The manufacturer and user must first make sure the field test uses the best material for the purpose. (3) The welder must make the test at a correct polarity setting. (4) He must apply rod at the right heat. (5) An actual cost record should be kept. And (6) records should show that materials being compared are doing the exact same quantity of work during the test period.

CONTRACTOR'S EYE VIEW

(Continued from page 64)

• Overload and its affect on equipment cost came in for discussion from the floor, and from a prepared statement by one manufacturer's representative. The question produced no factual data, but Armstrong admitted readily that his firm was guilty along with other contractors in overloading their equipment.

The rule-of-thumb of Groves on scraper loading: "Don't load any scraper over ¾ minute with one tractor pushing, whatever the material. Larger loads take excessive time and foul up the push-loading operation, which is a key to the whole job."

On the subject of tandem pusher operation (such as has been advocated by some—see Kenneth Park's article in *Roads and Streets,* October, 1957) Armstrong reported that the Groves organization doesn't approve of such loading because of false economy in that it shows up in repairs and maintenance, which will more than offset the production attained.

The "Pay Off"—How Much as Well as How Good

The final consideration in field testing of hard-surfacing materials consists in an accurate estimate of the exact work accomplished by each during the test. Although mentioned last, this is, of course, just as important in reaching a fair and accurate conclusion as any of the other three.

The ideal set-up is to have the material being tested operated side by side on exactly the same tonnage or footage of the same material. However, great care must be exercised to see that they are actually both performing the same quantity of work. A common use for comparing hard-surfacing materials is on shovel teeth. In many cases where the teeth are faced with two or more materials for comparison, no poorer choice of a test spot could be made. The reason for this is that plainly where a shovel is operating against a bank at its side, no two teeth are actually doing the same amount of digging and therefore comparisons of their individual wear rate are without any real factual meaning.

Unless one is sure that the bucket will be digging head-on during the comparison, it is better to face the entire set with the same rod and run for a desired time and then repeat this procedure using a different material all around.

Results on crushing roll shells also have often been incorrectly interpreted. This is apt to be the case where each shell was faced with a separate material. Here the common mistake is not to recognize that the driving roll nearly always wears considerably faster than the driven roll.

New Products

Reader Service Postal Card Opposite Page 113

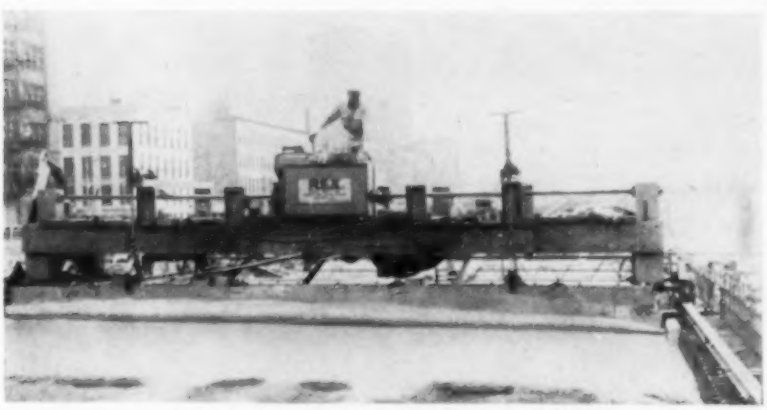
Compactor or Hauler

The new model "Duo-Pactor" here shown has a dump body to speed lightening or emptying of ballast, and can also be used as an off-highway hauler with an 8 to 12-cu. yd. payload capacity. As a compactor it combines the functions, of steel and pneumatic equipment, rubber rolls being used for the initial passes, after which the steel roll is lowered to complete compaction. Built-in scarifier, back of drive wheels, can be used for ripping hardpan, gumbo, or blacktop, as well as clod-breaking and leveling fill ahead of the compactor wheels. Total loaded weight is 50,000 lb., including a 32,000-40,000-lb. payload.

Seaman-Gunnison Corp., 2763 S. 27th Street, Milwaukee 15, Wis.

For more details circle 101 on Enclosed Return Postal Card.

New "Duo Pactor," Powered by an 88-hp International Tractor, Modified as a Two-Wheel Prime Mover



Rex Concrete Finishing Machine for Bridges

Concrete Finisher

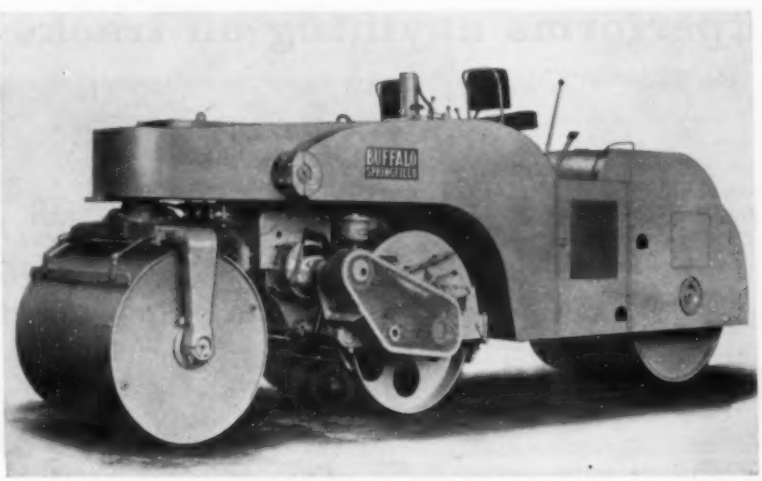
A concrete bridge finishing machine has been added to the "Rex" line. Incorporating all the design and construction advantages of the standard Rex concrete road finishing machines, the bridge finisher is tailored to customer specifications and produced on a made-to-order basis. It can be converted into a standard road finishing machine with a minimum of labor. Having extreme all-around flexibility, these machines are adjustable both in elevation of the large screed and in frame width, so that one machine can take care of most width requirements.

Chain Belt Co., Milwaukee 1, Wis.

For more details circle 102 on Enclosed Return Postal Card.

Vibratory Roller

The Buffalo-Springfield Model KX-25EV 3-axle tandem vibratory roller, features an exclusive principle of vibration compaction, with an independent power unit mounted between the end guide roll and the central roll. This unit transmits power to a high speed eccentric axle shaft supported by extra heavy bearings and running through the center of the middle guide roll, shaft turns at high thus creating the vibrating action. Mounted on the eccentric shaft is a second set of bearings supporting the roll itself which allows the roll

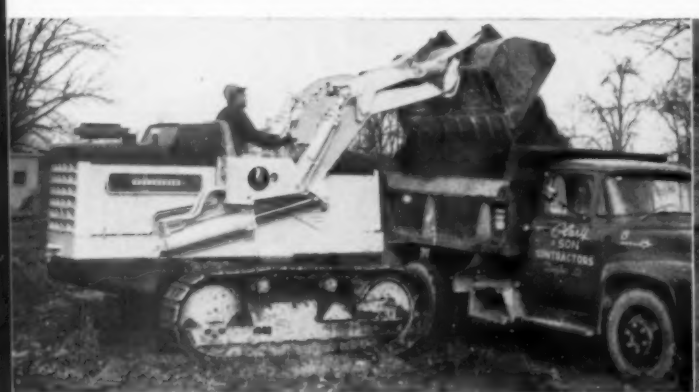


Buffalo-Springfield Model KX-25EV Vibratory Roller

(Continued on page 90)

model 12 PAYLOADER®

Outperforms anything on tracks because there's . . .



BUD CLARY, Partner of Clary & Son, Contractors in Dayton, Ohio, says, "The Model 12's maneuverability, balance, speed and ease of operation enables the operator to load out more yardage per hour than regular loaders of larger capacity. My operators tell me there is nothing to compare with the operating ease of this 'PAYLOADER'."

FERN WEISS, Contractor of Springfield, Oregon, says, "Loading this river bank gravel, which is extremely heavy per yard, I find the 'PAYLOADER' extremely stable; there is not the slightest tendency to tilt, even with the bucket heaped full. Easiest as well as fastest loader I have ever operated."

"Best money-maker I ever owned!"

"I can bid lower and still make as good a profit" says John Beniger, busy Sheboygan, Wis. contractor

"After many years of experience digging basements and grading, I thought I knew what a tractor-shovel could and could *not* do. But a year ago I bought a model 12 'PAYLOADER'. Soon I found out I had a new kind of tractor-shovel under me — that was easier to handle, that was faster, that had more digging power, a new kind of balance and that seated me where I got a smoother ride and could really watch the bucket action. I've got 1,000 hours on it now and I can't say enough good things about it."

More production

"It's production that puts money in the bank and it's more speed, digging power and balance built into the 12 that really moves dirt. I can dig an average basement with it in 3 hours less time — can load a 10 yd. truck from a stockpile in 1 minute. These are just two examples of what the model 12 can do — and all without strain on the driver."

Power-shift and power-steer

"Operating the Model 12 is a cinch. Steering requires only a light touch on the steering levers and there are no back-breaking foot brakes to pump in the process. Any speed change up or down is made instantly, on-the-go with only finger-tip effort. Forward-reverse shifting is just as easy. It's a real operator's dream. "Only a man who has put in a day on a regular tractor-shovel can appreciate what this model 12 power-shift and power-steer means to the driver. Digging basements requires about 700 shifts and turns a day, and when you've pushed and pulled with both arms and pushed with both feet that many times a day on a conventional machine, you've really had it."

Works where and when others can't

"See that photo where I'm backing up out of a basement with a full 2-yard load? Don't try it with a front-engine tractor-shovel — even with a smaller load. I do it all the time and it saves turns *and* time in basement work. That's one big advantage in not having most of the machine weight on the front idlers. Another advantage is that I can work on soft, spongy ground when others bog down at the front. Then, of course, there is the added traction I get from more even weight distribution along the tracks . . . also less strain on the front idlers."

Low Maintenance

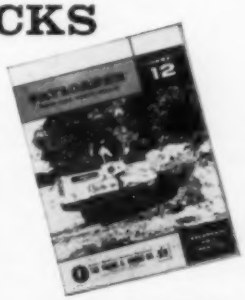
"The 12 is the most ruggedly built tractor-shovel I ever owned or ever saw. In almost 1,000 hours of heavy work maintenance and downtime have been practically zero, and that's important to me and also to my customers. They don't like to have a job delayed by machine failure any more than I do. There are many more good things about the model 12 that I could tell you, but they all add up to the fact that, as far as I'm concerned, it makes all other tractor-shovels obsolete."

. NOTHING LIKE IT ON TRACKS

The Model 12 is a complete, unit design 1¾ yd. tractor-shovel, instead of a tractor attachment. Its rear-mounted engine counterbalances the bucket load at all times . . . the full length of the tracks grip the ground, enabling you to dig more, carry more and deliver more.

You get operating speeds engineered for shovel work, a transmission designed for shovel work, plus ease of operation and maneuverability no other machine can provide. This Model 12 outperforms anything in its size . . . even machines with 50% larger bucket capacity.

You can't compete if your equipment is obsolete . . . so get full information on the remarkable Model 12 from your near-by "PAYLOADER" Distributor.



Get the COMPLETE story

on the radical new design MODEL 12 "PAYLOADER", the complete tractor-shovel, with improved traction, stability and balance "built-in" for the best performance in digging, carrying and dumping.

Modern Materials Handling Equipment

THE FRANK G. HOUGH CO.

LIBERTYVILLE, ILLINOIS

SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

. . . for more details circle 286 on enclosed return postal card

THE FRANK G. HOUGH CO.

768 Sunnyside Ave., Libertyville, Ill.

Send literature and other data on the 1¾ yd. model 12 "PAYLOADER".

Name _____

Title _____

Company _____

Street _____

City _____

State _____

6-C-1

New Products

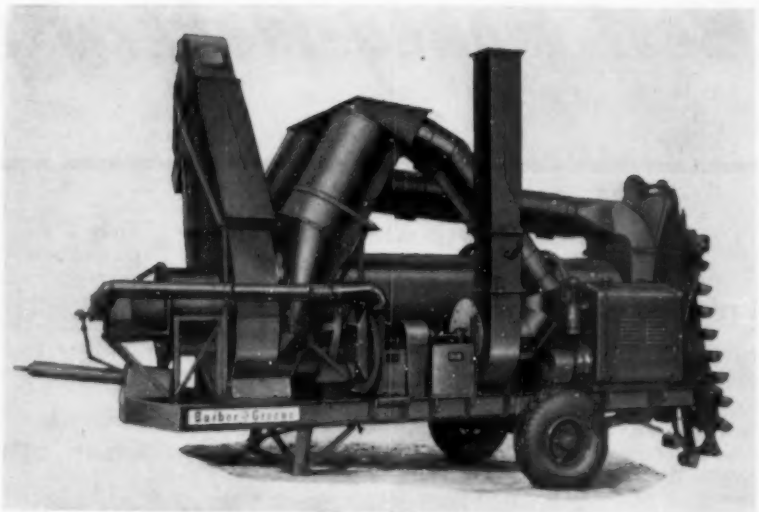
(Continued from page 87)

to revolve freely regardless of roller travel speed or vibrations per minute.

Vibrations per minute are regulated by the operator through the throttle and governor control cable. An hydraulic control permits raising and lowering the vibrating roll at will. This control also permits the machine to be operated as a long wheelbase 15-20 ton 2-axle tandem with normal weight distribution.

Buffalo-Springfield Roller Co., Division of Koehring Co., Springfield, Ill.

For more details circle 103 on Enclosed Return Postal Card.



Barber-Greene's Model 832 Aggregate Dryer

Compactor Attachment on "Michigan" 180 Tractor Dozer

Dozer Compactor Wheel

Open-face steel compactor wheels are now offered as standard attachments for the "Michigan" Model 180 tractor dozer. The quick-change attachments replace the rubber-tired wheels; no other modification is necessary.

The 60-in-diameter wheels, 22 in. wide on the front axle and 26 in. wide on the rear, develop 810 lb. of compression per inch of roll face. With fenders, the machine weighs 36,000 lb.

It is stated that the compactor wheels usually develop at least 95% Proctor in two passes when working in earth suitable for road construction.

Construction Machinery Division, Clark Equipment Co., P.O. Box 599, Benton Harbor, Mich.

For more details circle 104 on Enclosed Return Postal Card.

Asphalt Plant Dryer

Barber-Greene has announced the addition of the Model 832 aggregate dryer to their asphalt plant and component line. This brings the dryer line to a total of six models ranging in capacity from 10 to over 200 tph. The new unit is in the 40 to 55-tph range and is adaptable to either Barber-Greene's continuous-mix or batch plants of appropriate capacity, or to similarly rated plants of other makes.

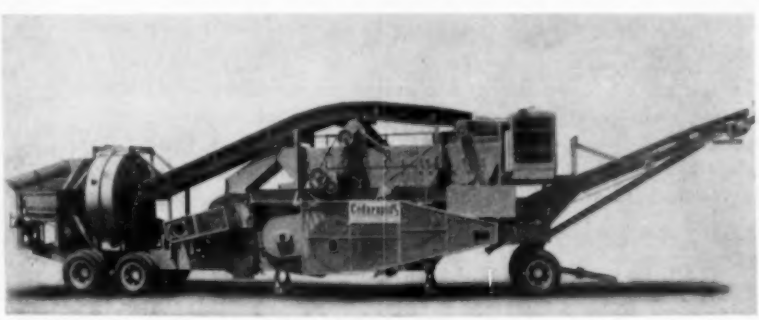
Both hot and cold elevators are integral on the Model 832 frame, the cold elevator telescoping for maximum ground clearance. Also carried is a two-cyclone collector unit to reclaim dust from the dryer's exhaust. Standard burners are of the low pressure air atomization type, with provision for high pressure steam atomization or natural gas if desired.

Barber-Greene Company, 400 N. Highland Ave., Aurora, Ill.

For more details circle 105 on Enclosed Return Postal Card.

Portable Crushing-Screening Plant

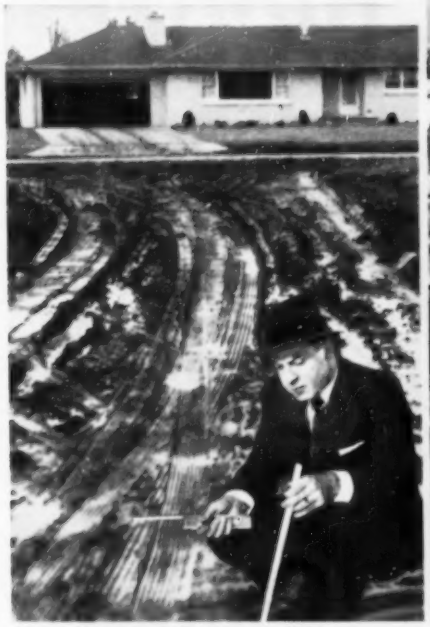
A new type of portable crushing and screening plant, called "Ham-



New Cedarapids "Hammeroll" Portable Secondary Crushing and Screening Plant

(Continued on page 94)

Now is the time for soil-cement...



New subdivision. Soil-cement would be a "natural" here.

Taxpayers in Daytona Beach, Florida, like these neat, low-cost soil-cement streets.

Soil-cement is the low-cost street that grows stronger year by year!

The maintenance crew can all but forget about the streets paved with soil-cement. It holds up like no other low-cost pavement.

Soil-cement gains strength from the minute it's placed. Core tests show it's often double in strength after several years of use.

Soil-cement is stronger inch for inch than any other pavement short of concrete. And its beam strength spreads the load over the subgrade. No softening, no potholing, no break-up in any climate. It's the 20-year-plus pavement. Maintenance costs *stay low.*

First cost? That's low, too, because in most cases 75% of your materials are free. You need only mix portland cement with almost any soil, then apply bituminous surface to the hardened base. In the case of old streets, the surfacing can be salvaged and mixed right in.

Paving is quick and easy. Contractors can build several blocks a day. Every day more engineers are finding that "now is the time for soil-cement." *Write for free booklet, "Soil-Cement Pavement."* Distributed only in the U.S. and Canada.

Low cost . . . it's the 20-year-plus pavement for

ROADS • STREETS
SHOULDERS • SUBBASES
AIRPORTS • PARKING LOTS

MODERN soil-cement

PORTLAND CEMENT ASSOCIATION
Dept. 6-28, 33 West Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of portland cement and concrete

. . . for more details circle 310 on enclosed return postal card

Without Redicote

Two asphalt-coated pebbles, magnified many times, show what Redicote can do. When these pebbles were subjected to a steady stream of water, the one above was stripped of asphalt. The one below was not. The reason? Asphalt on the pebble below contains Armour's new anti-stripping additive —Redicote.

With Redicote

REDICOTE®

makes asphalt stick —even to water soaked aggregate

Already tested and used in many states, Armour's economical asphalt additives are your best defense against stripping!

Many states have already tested and approved the Redicotes. They find that as little as 0.3% Redicote in an asphalt emulsion locks the asphalt onto *any aggregate*—even difficult-to-coat acidic, alkaline or locally available mixed gravel.

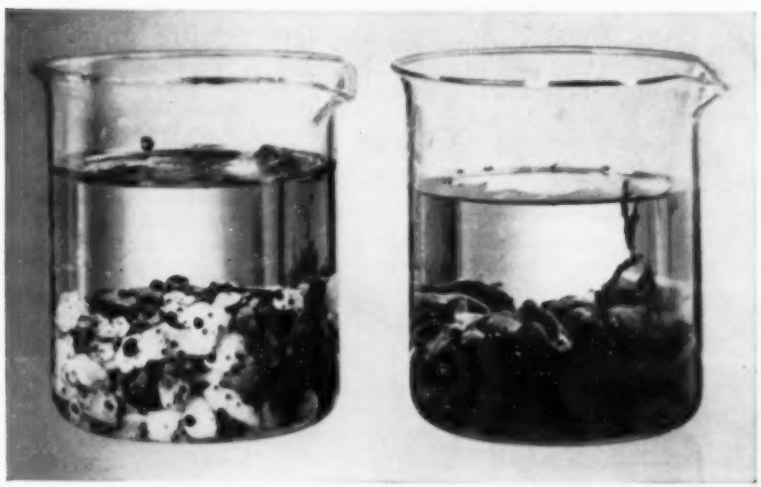
Every kind of weather is good asphalt—paving weather when you use Armour's Redicotes. They prevent stripping when used in road oil, cutback and emulsified asphalts or asphalt cements.

Redicote 75—100% active. Recommended for cold mix asphalt cutbacks where stability to extreme storage temperature is not required. Outstanding wetting-bonding agent under adverse weather conditions. Ideal for cutback asphalts and emulsions.

Redicote 2793—60% active. Economical and effective additive at 70°F. Right for most jobs where a free-flowing additive is required.

Redicote 2323—60% active. Developed to meet heat storage-stability requirements. Maintains effectiveness after 7 days at 450°C. Ideal for asphalt cements, where desired.

It is not necessary to modify the Redicotes. One of three basic formulas meets any asphalt requirement—hot or cold. Send for samples, and prove to yourself how Redicotes prevent stripping. Also ask for the new booklet describing the Redicotes.



Without Redicote *With Redicote*

Redicote 75 passes the Pennsylvania wet aggregate coating test

Only 0.4% Redicote 75 was added to RC-3 asphalt in beaker on right. No additive was used in the "control" asphalt on left. Pennsylvania aggregate was coated with the two mixtures under water. After static immersion, aggregate on the right coated with asphalt containing Redicote retained a 95% coating. Aggregate on the left held only 10% of its asphalt.

ARMOUR CHEMICAL DIVISION

© Armour and Company • 1355 West 31st St. • Chicago 9, Ill.

Leader in Progressive Fatty Acid Chemistry

RS-6-58

I want to learn more about Redicote Asphalt Additives!

Please send me: ☐ **The new Redicote booklet.**
Sample of ☐ **Redicote 75;** ☐ **Redicote 2393;** ☐ **Redicote 2323.**
☐ Additional data for coating the following type aggregate:

_____

NAME _____

TITLE _____

FIRM _____

CITY _____ STATE _____

Armour Chemical Division • 1355 West 31st Street • Chicago 9, Ill.

. . . for more details circle 236 on enclosed return postal card

New Products

(Continued from page 90)

meroll" announced by Iowa Manufacturing Co., uses a tandem arrangement of a roll crusher and a hammermill for high capacity secondary reduction. It is designed primarily for use in quarries where abrasive material is not a problem. Capacity of the plant depends upon conditions: extensive field tests in limestone quarries are stated to have produced from 450 to 500 tons per hour. Operation is similar to that of other Cedarapids portable tandem plants.

Iowa Manufacturing Co., Cedar Rapids, Ia.

For more details circle 106 on Enclosed Return Postal Card.

Stationary Batch-Type Asphalt Plants

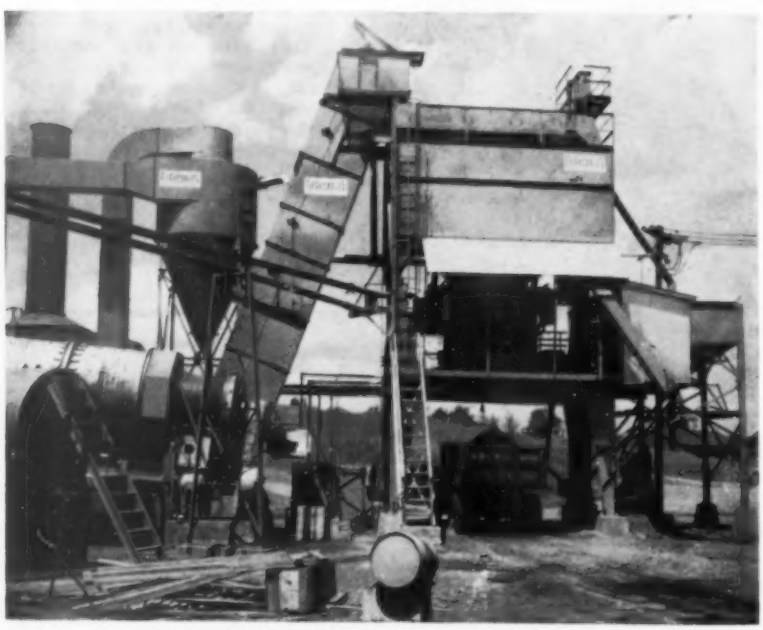
A complete new line of batch-type bituminous mixing plants, the Model H Series, introduced by Iowa Manufacturing Co., are available in six sizes, covering capacity ranges from 45 to over 240 tons per hour. The plants are designed to meet the needs of bituminous concrete producers whose market requirements can best be handled by stationary or semi-permanent installations.

Aside from the absence of running gear or self-erecting equipment, the Model H plants have most of the components and features of the Model G Series portable plants which have been on the market for five years.

The complete Model H Series is made up of 10 basic units, which can be combined into a number of different arrangements to meet specific job conditions.

Iowa Manufacturing Co., Cedar Rapids, Ia.

For more details circle 107 on Enclosed Return Postal Card.



Cedarapids Model H60A Bituminous Mixing Plant

Keeping Donner Pass Open

Snow-Fighting Equipment

To meet notoriously severe snow problems in the narrow confines of Donner Pass in California's Sierras, three especially equipped motor graders were put to work this year. These machines are Pettibone-Mulliken "Speedmatic" 4-wheel drive, 6-speed units, from which the blade, drawbar, circle, and blade controls have been removed to accommodate two saddle-mounted General Motors 145-hp diesel engines to drive the auger-type "Sno-Go" plow. A third GM diesel drives the grader. Estimated snow removal capacity of each unit is 20 tons per minute. Some of the drifts cleared last winter topped 28 ft.

Pettibone-Mulliken Corp., 4720 W. Division St., Chicago 51, Ill.

For more details circle 108 on Enclosed Return Postal Card.

Tractor Shovel

The newest "Trojan" tractor shovel, the 4-wheel drive Model 404, which will be made and distributed in 1958, is illustrated here loading shot rock for processing into crushed stone.

The new product is designed to handle all types of materials, loading directly into high sideboard railroad cars as well as into trucks. Rated at 4 cu. yd. capacity, the Model 404 weighs 40,500 lb, and has an operating capacity of 12,000 lb.

The Yale and Towne Manufacturing Co., Chrysler Building, New York 17, N.Y.

Model 404 Loading Shot Rock for Processing into Crushed Stone

For more details circle 109 on Enclosed Return Postal Card.

Fork Lift for General Service

A low-cost answer to the industrial handyman's need for on-the-job material handling, stockpiling, clean-up and other storage yard jobs is the new Massey-Ferguson "Work Bull" fork lift. Providing 10 quick-change attachments, with no additional hydraulics, this lift handles all types of solid or semi-solid materials in bulk and packaged form. Because of its low silhouette, it can operate under a clearance of 8 ft 2 in. The lift height is 10 ft. without mast extension. Capacity 4000 lb.

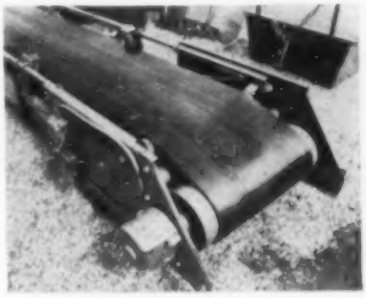
Massey-Ferguson Industrial Division, 1009 South West St., Wichita, Kan.

For more details circle 110 on Enclosed Return Postal Card.

"Work Bull" Fork Lift Handling Snow Fence

Self-Driven Head Pulley

The Bauer single unit conveyor drive, incorporating motor, gears, and all moving parts within the head pulley drum, has recently been introduced into this country from Germany. Space, time, and power savings are claimed to result from the compact design; overhead V-belt drives and supporting superstructures and catwalks are eliminated; maintenance is minimized. Installation is simplified—both in terms of the physical job and layout problems. Safety is another outstanding feature. There are no exposed chains, sprockets, etc. Pulleys are available in all standard widths. The full Bauer line will be on display at the National Materials Handling Exposition, Booth 1538, Cleveland, June 9-12.



Bauer Motorized Head Pulley on an Outdoor Installation

George von Opel Corp., 15 William Street, New York 5, N.Y.

For more details circle 111 on Enclosed Return Postal Card.

For Complete Patching Jobs

The "Tar-Baby" here pictured provides for a combination of all bituminous patching operations with a single vehicle. The roller, which can be attached quickly to the rear of any dump truck, uses the truck weight to develop necessary compacting pressure. It is hydraulic controlled, and when not in use is drawn up under the dump body. Except for the addition of one valve, it can use the existing hydraulic system on any regular dumper. The roller adds little to the vehicle weight and can be removed in minutes.

An air compressor is offered with the roller for front mounting with an extra long hose to facilitate chipping-out operations well ahead of patching.

The "Tar-Baby" Patch Roller

American Coleman Co., Littleton, Colorado.

For more details circle 112 on Enclosed Return Postal Card.

Roper and Chevrolet

Roper Manufacturing Company announces the adaptation of the "Roper Highway Digger" to Chevrolet 4-wheel drive trucks. The truck need only to be equipped with a rear power take off, for the digger is complete with power plant and universal attaching kit. Maximum diameter of hole, 14 in.

Roper Manufacturing Company, 7th and Elm Sts., Zanesville, Ohio.

For more details circle 113 on Enclosed Return Postal Card.

Chevrolet Truck with Roper "Highway Digger"

Cement Unloader and Batcher

The dual-purpose "Grasshopper" is the most recent addition to the C. S. Johnson line of portable units for the construction industry. Serving both as a cement unloading and batching plant, the unit is equipped with one or two manual or automatic 14-cu. ft., 1,000-lb. cement batchers. Cement for paving operations is moved directly from rail-

(Continued on page 98)

During construction of vital Interstate Highway section, Campanella and Cardi's 22½-ton Mack dumpers once again proved that they are built to get the tough jobs done, with little or no down time and only routine servicing.

Vital highway links

Maneuverability and ease of handling pay off in the tight spots. On the Division Street project in Pawtucket, R. I., space was at a premium. Spotting, dumping, or traveling over busy city streets, the combination of Mack maneuverability, and the positive traction provided by Mack's exclusive Balanced Bogie with Power Divider, materially speeded up work cycles on this project.

"We finished off the Interstate Highway job in record time, thanks to our Macks." Campanella and Cardi set new records for a job of this type, which included relocating the channel of the Big River, excavating for bridge construction, and hauling in heavy materials.

rushed to completion

"As the trucks go . . . so goes the job." That's what Campanella and Cardi Construction Co. of Providence report. They credit their 55 Mack trucks with maintaining their reputation for record-time contract completion.

They'll tell you that with Macks pacing the job, the hauling-dumping cycle proceeds on-the-double . . . shovels operate at full capacity . . . down time is held to a minimum.

Husky Mack dumpers take the day-in, day-out beatings delivered by the tons of rock and earth dropped from the shovels . . . and keep coming back for more.

Campanella and Cardi will tell you that Mack dependability speeds their entire operation. So will the Mack user nearest you. Get his name from your Mack branch or distributor. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

MACK
first name for
TRUCKS

. . . for more details circle 299 on enclosed return postal card

New Products

(Continued from page 95)

"Grasshopper" Unloader and Batcher

road hopper cars or cement truck trailers to batch trucks.

When the "Grasshopper" is used as a transfer plant, the batchers are replaced by a 42-bbl capacity extension to the standard 33-bbl surge hopper. Dump trucks and cement trailers can be filled at a 300-bbl per hour rate—380 bbl per hour by special order. A compressor supplies low-pressure air for cement aeration.

C. S. Johnson Co., (subsidiary of Koehring Co.), Champaign, Ill.

For more details circle 114 on Enclosed Return Postal Card.

New Vibratory Compactor

Completing the "Terrapac" line, the CM-15 tamper for all granular materials, such as sand, crushed stone, and gravel, is now in production. Weighing only 242 lb., it produces a 2800-lb. impact with 2350 vibrations per minute; is self propelled and travels up to 55 ft. per minute. Handle vibration is reduced through two sets of shock absorbers using opposed springs instead of hydraulic fluid.

Vibro-Plus Products, Inc., Stanhope, N.J.

For more details circle 115 on Enclosed Return Postal Card.

"Terrapac" CM-15 Tamper

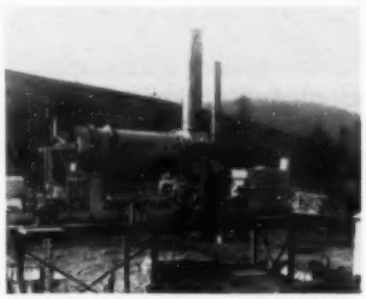
For Faster and Cheaper Surveys

"The "Geodimeter", an instrument of Swedish manufacture for the measurement of traverse distances, is now available in the United States. In California, it has been tested by the Division of Highways on some 200 lines ranging from 1200 ft. to 17 miles, with errors of closure between 1:25,000 and 1:60,000 when based on secondary scheme quadrangles of the U. S. Coast and Geodetic Survey, and about 1:100,000 when observing across a main scheme net. The maximum error of any single measurement was 0.5 ft., and that under extremely adverse conditions. An instrument of substantially greater accuracy is now in development.

Operating by reflection from a target, the Geodimeter is not affected by temperature, light rain, or wind. Costs savings in comparison with conventional methods are reported to be from 30% to 50% in level, unobstructed terrain, and much greater in rough country.

Berg, Hedstrom & Co., Inc., 1170 Broadway, New York, N.Y.

For more details circle 116 on Enclosed Return Postal Card.



White's Improved 20 to 25-tph Plant

Portable Asphalt Plant

A new 20 to 25-tph portable asphalt plant is announced by White Manufacturing Co. An extra large dryer, 52 in. by 12 ft. and an oversized blower-burner combination are noted by the manufacturer as insuring high production of hot mix asphalt, even with wet aggregate.

The entire plant, except the feeder bin, is mounted on one frame for easy portability and is available without wheels for stationary installation. All control gates are air-operated and the entire plant is powered by one engine. There are either twin or single axle pug-mixer with option of weigh scales for aggregate and bitumen. Ask for circular No. 47-A.

White Manufacturing Company, Elkhart, Ind.

For more details circle 117 on Enclosed Return Postal Card.

Fiberglass Tubing

A new, structural fiberglass tubing has been developed by Gar Wood's Fiberglass Division. The new product has already been incorporated into the design of fiberglass highway structures, antenna masts for land and maritime use, utility poles and a variety of conventional products.

Signs on Fiberglass Support

The tubing is stated to be strong, impervious to soil chemicals, weathering and extremes of temperature and light.

Gar Wood Industries, Inc., Wayne, Mich.

For more details circle 118 on Enclosed Return Postal Card.

4-6 Ton Tandem Roller

A new 4 to 6 ton retractable wheel roller added to the Huber-Warco tandem line is claimed to offer maximum portability. The retractable wheels and towing hitch are operated by a power hydraulic system, providing quick and easy change from working to transport position.

This new tandem has the exclusive feature of a tail-shaft governor, combined with a torque converter and water-cooled engine. Other features include: a foot-operated disc-type brake located on the transmission output shaft; variable speed steering valve; extra large 34-in. diameter guide roll; and easily removed kingpin housing.

Huber-Warco Co., Marion, Ohio.

4-6 Ton Tandem Roller

For more details circle 119 on Enclosed Return Postal Card.

(Continued from page 102)

Dump body mounted on Dodge 900 chassis with Custom cab.

Dodge Heavy-Duty Finance Plan is designed to save you money!

Need a new truck, but need to watch your working capital, too? The Dodge retail finance plan for heavy-duty trucks was designed for just that situation. It lets you operate modern, efficient trucks without burdening yourself with excessive finance charges.

Designed with the same understanding of truck problems that has made Dodge *Power Giants* outstanding, the Dodge Heavy-Duty Retail Finance Plan is tailored to your needs. Whether you need one truck or several, you can finance your purchase with a minimum down payment, and with lowest financing cost. Payments can be arranged over an extended period.

What kind of equipment can be financed with this plan? Any Dodge medium-duty, heavy-duty (400 through 900 models) or four-wheel-drive trucks, plus extra equipment, including bodies mounted on the trucks.

This new plan makes it both easy and economical for you to get *Power-Giant* advantages: exclusive Power-Dome V-8 engines that keep maintenance at a minimum . . . rugged "Job-Rated" construction . . . famous Dodge economy and dependability . . . advanced Dodge styling.

Let your Dodge truck dealer show you how this Heavy-Duty Retail Finance Plan helps truck operators with established credit own thrifty new Dodge *Power Giants*. See your dealer soon.

DODGE *PowerGiants*

. . . for more details circle 257 on enclosed return postal card

Profits Go Up On Every Job

With fabricated I-beam frame for rugged durability and top load-carrying strength on roughest possible terrain.

With 88" of inside width and a complete range of body and chassis lengths to provide the loading capacity you need.

A MORE RUGGED, LOW COST Dump Trailer than the new Fruehauf "Toughy" has never been built for profit-conscious, cost-conscious roadbuilders!

Its bridge-type fabricated steel I-beam chassis frame construction is your assurance of durable and constant service under maximum payloads on all kinds of terrain. Extra years of performance are actually *built-in* the Toughy—and that adds up to extra dollars of earnings for you.

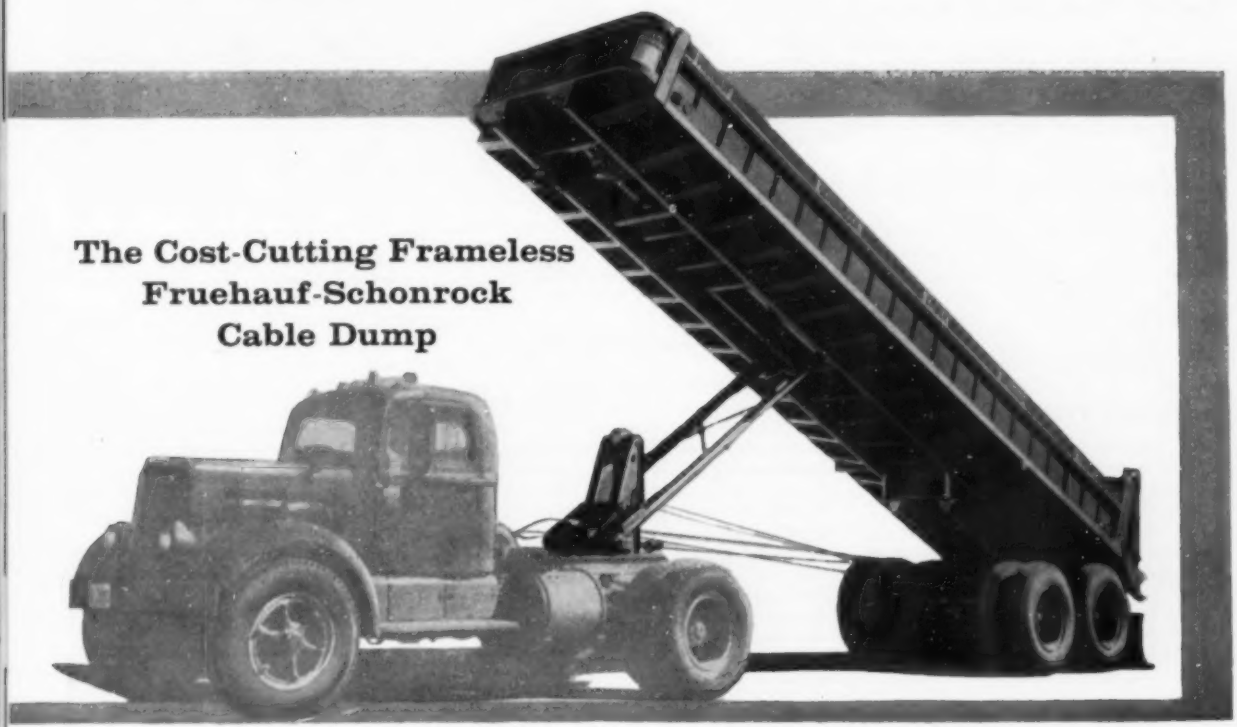
Tandem and single axle units in a broad range of body and chassis lengths are available to suit your weight distribution requirements. Capacities range from 8 to 26 cubic yards. In the longer tandem axle unit, bridge formula design can be applied to provide you with maximum legal capacities. Low or high sides can be chosen—inside width is 88" in either case. Wide front coupler and no-hop P2 tandem are exclusive Fruehauf features.

There isn't a tougher, more durable, more profitable hoist-type Dump Trailer built today. Compare with the Toughy before you buy!

For Forty-Four Years—More Fruehauf Trailers On The Road Than Any Other Make

FRUEHAUF BUILDS AMERICA'S BIGGEST LINE OF DUMP TRAILERS, PLATFORMS, CARRYALLS, AND BULK TANKS FOR THE ROADBUILDING INDUSTRY.

With Fruehauf's
2 RUGGED NEW DUMP TRAILERS!



The Cost-Cutting Frameless Fruehauf-Schonrock Cable Dump

With redesigned booster fifth wheel for faster dumping with less strain on truck and cable than ever before.

With redesigned body frame for greater strength and increased "flex" in center beam to absorb even the greatest shock loads.

STILL THE MOST ECONOMICAL Dump Trailer in America to purchase or maintain, the simply-designed, ruggedly-built, frameless Fruehauf-Schonrock Cable Dump now has more cost-cutting, time-saving features than ever!

Faster dumping with less strain on truck and cable is achieved by new, longer booster arms and larger rollers. Higher stockpiles are provided by newly-designed offset tailgate hinges, which swing the gate quickly out high and clear of the pile. Shock loads of all kinds are more easily absorbed by the tougher, more flexible body frame.

The cost of this revolutionary cable unit still remains lower than that of most competitive hoist units with or without full chassis frames. Payloads are still up to 4,000 lbs. greater because of the frameless design and bridge formula application. All wheels stay fully grounded throughout dumping, and the cables can be used to get either truck or Trailer out of mud or holes.

No other dump of any kind does so much work for so little cost!

FRUEHAUF TRAILERS

World's Largest Builder of Truck-Trailers

FRUEHAUF TRAILER COMPANY

10949 Harper Avenue • Detroit 32, Michigan

SEND FULL INFORMATION WITHOUT OBLIGATION ON THE NEW

☐ **CABLE DUMP** ☐ **HOIST DUMP**

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

. for more details circle 268 on enclosed return postal card

New Products

(Continued from page 98)

Electric Generating Plants

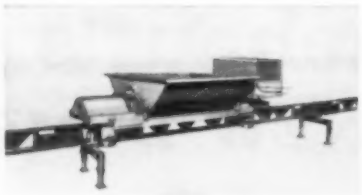
Three new high-capacity, alternating current, gasoline engine-driven electric plants in 1,000,000, 125,000 and 150,000 watt sizes have been announced by D. W. Onan & Sons, Inc. They feature Onan-built alternators with newly developed static excitation and magnetic amplifier regulation, coupled to water-cooled Waukesha gasoline engines. Engine, alternator, exciter and control panel form a single compact unit, available in all standard voltages.

D. W. Onan & Sons, Inc., Minneapolis, Minn.

For more details circle 120 on Enclosed Return Postal Card.

Materials Handler

An improved, heavier-duty "Railporter" is now offered by Chain Belt Co. The new model is a portable self-propelled materials handler that transports concrete and other construction materials over an easily set up monorail system. It makes its round trips from supply point to destination unattended, even stopping automatically.



Rex Railporter

The power unit and the trailer unit carry a 29.2 liquid-level cu ft capacity; 20 cu ft of concrete or 3000 lb of blocks, bricks, stone, or lumber. The 12-ft rail sections can be set-up at the rate of 450 ft of track per hour with a three-man crew.

Chain Belt Co., 4701 West Greenfield Ave., Milwaukee 14, Wis.

For more details circle 121 on Enclosed Return Postal Card.

Spreader Screed for Trucks

A new double action screed that attaches easily and quickly to the back of any standard dump truck is the latest development of the Browning Manufacturing Co. It makes a spreader out of the truck, and can be used for asphaltic concrete, pre-mix, caliche base, gravel, and other products. The double action is said to give a highly compact uniform layer.

Browning Manufacturing Co., San Antonio, Texas.

Browning's Double Acting Screed

For more details circle 122 on Enclosed Return Postal Card.

On Display at Hanover Fair

A German manufacturer, Edward Linnhoff Maschinenfabrick, has displayed the following road construction and maintenance machines at the 1958 German Industry Fair, Hanover. All bear the trade name "Linnhoff":

Fully-Automatic Charge Mixing Plant "Kompaktomat"—hourly output, 20 tons of mastic asphalt, 30 tons of rolled asphalt, 40 tons of tarmacadam.

Soil Stabilizer—for cement and black binder, working width 6 ft. 8 in. to 8 ft. 4 in., stabilization depth 9 in., daily output 7,200 sq. yd.

Standard Road Finisher – working width up to 15 ft., laying capacity up to 100 tons p/h.

Big Finisher—Working width up to 15 ft., laying capacity up to 100 tons p/h.

(Continued on page 103)

GARRISON

POWER STEERING

Now available for

DIAMOND T TRUCKS

Models 830-42M, 730-32M, and 830-36M

. . . for more details circle 272 on enclosed return postal card

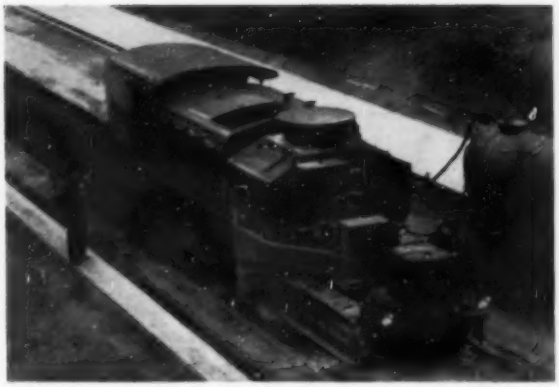
Drivers say they like Diamond T Trucks because of their excellent ride, faster shifting and *easy steering*—thanks to Garrison Power Steering.

With hydraulic power doing 80% of the work of turning, drivers get rigs in and out in a hurry, with far less fatigue. Equipment takes less of a beating, too. Shocks from rough terrain are absorbed by the power cylinder—not the steering mechanism.

Garrison Power Steering is available for larger models of Diamond T Trucks and can be installed as optional equipment at the factory, or provided in kit form for field installation. Get in touch with your Diamond T dealer today for complete information.

Garrison Power Steering is available for most other makes and models of heavy and medium trucks, truck cranes, and wheeled material handling and off-the-road equipment.

4609 East Sheila Street
Los Angeles 22, California



The Linnhoff Soil Stabilizer

Mastic Asphalt Boiler—capacity 2.35 cu. yd.; (4 tons).

Machine for Laying Mastic Asphalt—working width from 10 ft. up to 26 ft. 8 in.

Motor-Pump-Spraying Machine "Rhein"—550 to 730 imp. gal., with spray bar, working width 10 ft.

Motor Compressor Spraying Machine "Rhume"—with or without self propelling device, 100-145 imp. gal.

Universal Road Sweeping and Gritting Machine "Donau," and four other machines.

Edward Linnhoff Machinenfabrik, Berlin-Tempelhof, Germany.

For more details circle 124 on Enclosed Return Postal Card.

Grease Gun Cartridge

A new, easy-to-use grease gun cartridge, introduced by Lubriplate, is claimed to save time, and eliminate waste. It contains Lubricate No. 630-2, a high temperature, extreme pressure, water-repellent grease-type lubricant, adaptable for practically all general purpose lubrication.

The cartridge is designed to fit all standard cartridge guns. The standard package contains 10 cartridges.

The Lubriplate Division, Fisk Brothers Refining Co., Newark, N.J.

For more details circle 125 on Enclosed Return Postal Card.

New Truck Engine

A new GM diesel engine for trucks is stated to be 750 lb. lighter than its nearest competitor in the 210-hp. range. The lighter weight is attained through the liberal use of aluminum alloys in the cylinder block and other major components.

The engine, a 6-cylinder model, weighs 1710 lb. and retains all the durability features of GM diesel standard cast iron models. Its design includes the recently introduced four-valve head and new economy fuel injectors and pistons.

The new unit develops its peak horsepower at 2100 rpm with its maximum torque of 577 lb. ft. occuring at 1200 rpm.

Detroit Diesel Engine Division, General Motors Corporation, 3400 W. Outer Drive, Detroit 28, Mich.

For more details circle 126 on Enclosed Return Postal Card.

Conveyor Belt

A new Quaker conveyor belt the "Shockmaster" is specifically designed to allow the belt to be turned over after the first carrying side is no longer satisfactory. It is a medium weight, double duty belt, extremely flexible, with a high impact resistance for use over smaller-than-usual pulleys on short center hauls.

Quaker Rubber Division, H. K. Porter Co., Inc., Tacony and Conly Sts., Philadelphia 24, Pa.

For more details circle 127 on Enclosed Return Postal Card.

(Continued on page 113)

TRANSIT
MODEL 2cF
$720.00

NO REPLACEMENT NEEDED after you acquire a

WARREN-KNIGHT Instrument

The design and construction of these superb instruments is so superior and so different that it is prudent to investigate them. After all, an instrument that can promise a very minimum of repairs and maintenance—and does promise that it will probably never be replaced during your entire remaining professional carrer should be in YOUR equipment.

FREE 10 DAY TRIAL—So sure are we of your reception to this magnificent instrument that we offer it FREE for 10 days trial test on your own work sites. You will find that over 40 superior advantages will save you time, concerning this unique instrument.

Ask for Bulletin R-86 that lists Full Details.

OUR 50th YEAR

WARREN-KNIGHT
136 N. 12th St., Phila. 7, Pa.

. . . for more details circle 336 on enclosed return postal card

Do the BIG SWEEPING JOBS the easy, low-cost way!

CARSON STREET KING SWEEPER

Many Year Around Uses!

Streets and Alleys • Airport Runways
Road Construction • Parking Lots and Driveways
Asphalt Paving Preparation • Factory Areaways

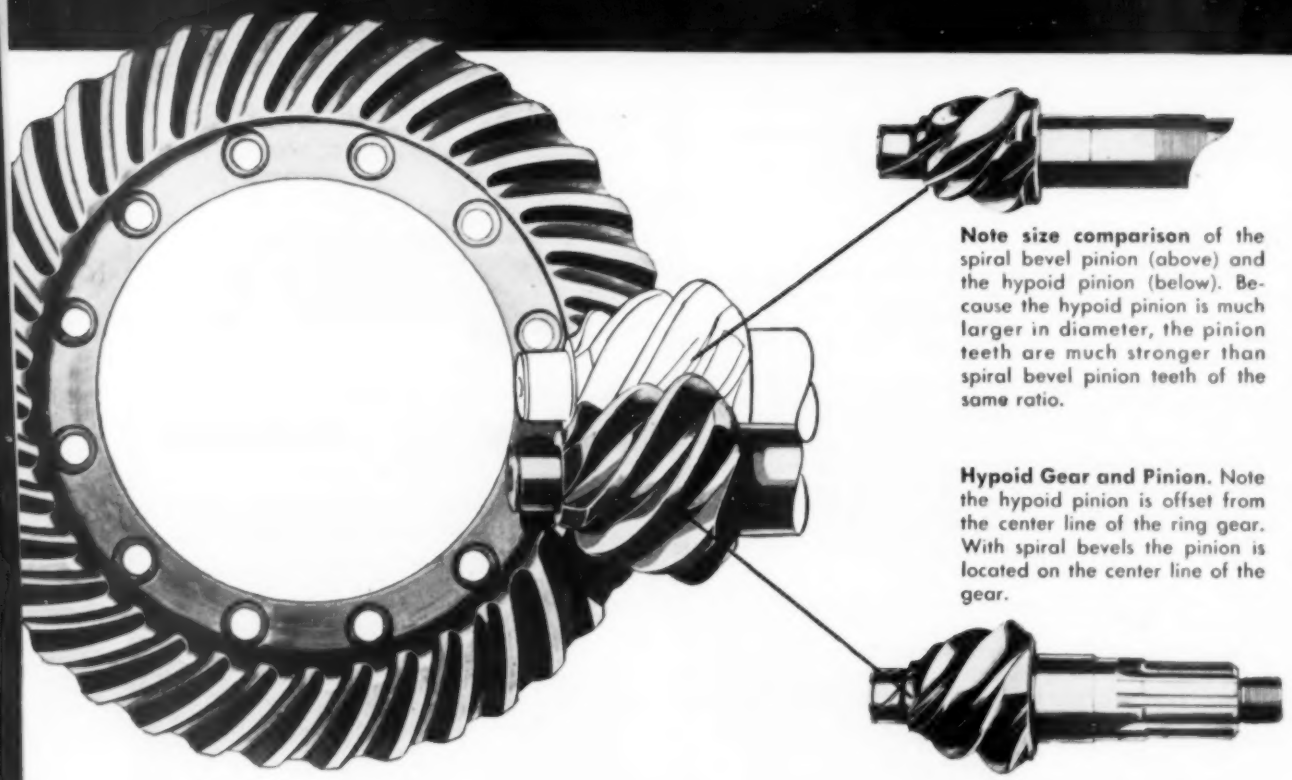
ADAPTABLE to any pulling unit with POWER TAKEOFF SHAFT!

Write for full details today!

CARSON MANUFACTURING CO.
P. O. BOX 256 Dept. RS Maryville, Missouri

. . . for more details circle 249 on enclosed return postal card

Hypoid Gears 30% More Torque Than Spiral Bevels!



Note size comparison of the spiral bevel pinion (above) and the hypoid pinion (below). Because the hypoid pinion is much larger in diameter, the pinion teeth are much stronger than spiral bevel pinion teeth of the same ratio.

Hypoid Gear and Pinion. Note the hypoid pinion is offset from the center line of the ring gear. With spiral bevels the pinion is located on the center line of the gear.

Products of ROCKWELL-

Have Capacity

Timken-Detroit pioneered and developed hypoid gears for trucks of every type and capacity... and today is the acknowledged leader in the field!

A FEW OF THE MANY LEADERS WHO USE TIMKEN-DETROIT AXLES WITH HYPOID GEARS
Quinn FREIGHT LINES
DELTA LINES, INC.
RED STAR FOR Dependability
D·C DENVER CHICAGO TRUCKING CO., INC.
CONVERSE TRUCKING SERVICE
INTERSTATE MOTOR FREIGHT SYSTEM
Indianhead TRUCK LINE, INC.
Johnson Motor Lines, Inc.
MUSHROOM
SPECTOR MID-STATES

The trend of the trucking industry today is to hypoid gears, because their torque capacity is 30% greater than that of spiral bevel sets of the same ring gear diameter and ratio! The result is lower maintenance costs, greater dependability, and lower-cost operation. And, since hypoid gears do every driving axle job better . . . from the smallest single reduction axles to the largest double reductions . . . more and more operators specify them every day.

Hypoid gearing is another plus feature found in all Timken-Detroit Letter Series Single and Tandem Driving Axles!

. . . for more details circle 327 on enclosed return postal card

Plants at: Detroit, Michigan
Oshkosh, Wisconsin • Kenton and Newark, Ohio
New Castle, Pennsylvania

TIMKEN Detroit AXLES
ROCKWELL-STANDARD CORPORATION
TRANSMISSION AND AXLE DIVISION
DETROIT 32, MICHIGAN
The Accepted D A Standard
TRADE MARK REGISTERED

©1958, R-S Corp.

WORLD'S LARGEST MANUFACTURER OF AXLES FOR TRUCKS, BUSES AND TRAILERS

STANDARD Corporation

Heltzel Flex-Plane

UNITIZED BATCHING PLANTS to further speed set-up and dismantling time . . . to give you even greater on-the-job flexibility. The new Heltzel Unitized Plant—like these on a G. Toccalino & Son job in Detroit—is designed in three easy-to-handle sections that go together in minutes. This installation is set up as push-button drive-through for extra fast service. Batcher and scale unit is integral part of center section . . . a real time-saving innovation. (Note new Heltzel E-4 twin-batcher cement plant.)

2202

THE HELTZEL STEEL FORM AND IRON

FLEX-PLANE COMBINATION FINISHER-FLOAT does two jobs in one, reducing crew time to an absolute minimum. The combining of these two jobs is a natural—results in a better finish in faster time. This new machine was thoroughly tested on several jobs last season. Contractors report 4000 feet of 24-foot pavement was floated and finished in a normal day with but two or three hand finishers required. Get the facts on this profit maker before submitting too many quotations.

Engineering

brings you unitized batching, improved forms and a new way to finish concrete

Modern highway design demands top efficiency in highway construction machinery. Portable . . . versatile . . . automatic . . . *fast*.

That's why Heltzel Flex-Plane Engineering works to give you the most modern road-building equipment obtainable. Up-to-date engineering, for example, has produced a definite contractors' preference for Flex-Plane over all other makes. This preference is based, of course, on proved performance.

Find out now what Heltzel Flex-Plane Engineering can mean to you — call on actual users of Heltzel and Flex-Plane equipment, and prove to your own satisfaction that this is the *modern* equipment for modern highway construction.

COMPANY • Warren, Ohio

HELTZEL DUAL DUTY FORMS, such as those shown in use on the Plattsburg SAC base, have been redesigned to assure fast setting and stripping with maximum strength-weight ratio. Sizes available to exactly suit your job requirements.

. . . for more details circle 282 on enclosed return postal card

Lima Austin-Western 111 Crushing and Screening Plant, owned by Ronald Weaver, Dansville, Mich. High-grade specification material is being produced at an average rate of 1000 cu. yd. per 9 hr. shift.

"Lima Austin-Western will outlast and outproduce"

Says Ronald Weaver

Ronald Weaver, Dansville, Mich., has owned and operated a Lima Austin-Western 111 Crushing and Screening Plant since January, 1953. With his 4-man crew, he works all year 'round, producing specification material meeting county and State requirements.

Mr. Weaver says: "I have owned and operated other plants, and I am convinced that over a period of time a Lima Austin-Western will outlast and outproduce other comparable machines. I depend on this plant to show a reasonable profit, and it has produced all that can be expected.

"It is truly a portable machine. Not long ago I moved the 111, power plant, feeder, two dump trucks, dragline, bulldozer and other miscellaneous equipment 20 miles. The time involved in dismantling the equipment, loading, setting up, and resuming operation was only 3 hours.

"The quality of the equipment is shown by the fact that it has never required a major overhaul since it went into operation 5 years ago. But the most obvious reason for buying and using Lima-Austin-Western is the fine relationship and cooperation between not only the dealer and the operator, but more important, the manufacturer, the dealer and the operator."

Get the high-tonnage, low-cost Lima Austin-Western story from your nearby distributor . . . or write direct.

DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD

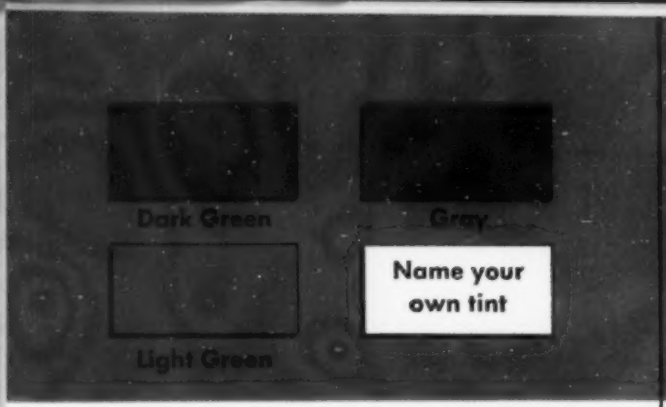
LIMA AUSTIN-WESTERN Crushing, Screening and Washing Equipment

BALDWIN · LIMA · HAMILTON

CONSTRUCTION EQUIPMENT DIVISION • LIMA, OHIO

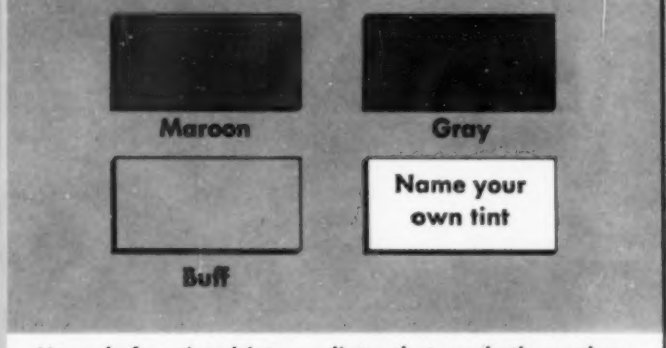
5829

. . . for more details circle 240 on enclosed return postal card



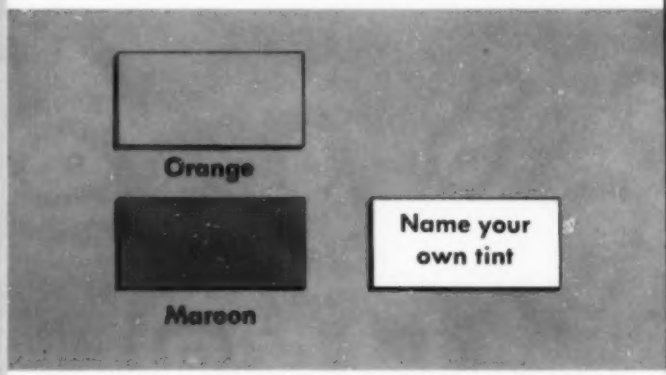
Never before weather-resisting tinted *finishes* that are also rust inhibitive . . .

Now you can give steel structures distinctive color . . . or decorative color . . . along with greater durability than ever

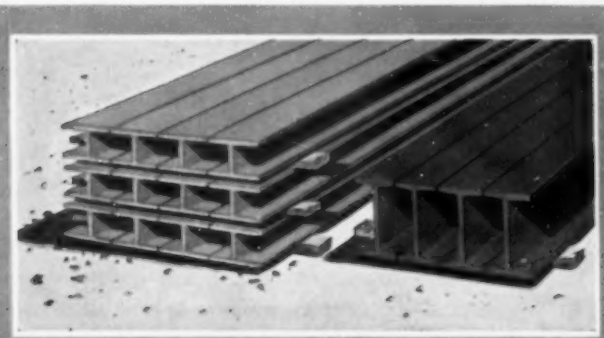


Never before tinted *intermediates* that are *both* weather resistant and rust inhibitive . . .

Now you can specify intermediate colors in sharp contrast and aid visual inspection for "holidays"



Never before anti-corrosive *primers* that are also tintable and weather resistant.



Now you can eliminate on-the-job mix-ups by using structurals shop-primed in *coded* M50 pigment colors

Proof M50 pigment Defense in Depth paints deliver color opportunities entirely beyond those of ordinary anti-corrosive paints

Wide color choice has never before been available in *all* coats of anti-corrosive specification paint systems. Now *M50* basic lead silico chromate pigment* gives you an entirely new color specification freedom . . . in primers as well as intermediates and finishes . . . along with all-coat rust inhibition, all-coat weather resistance. Some of the opportunities this presents are suggested above. You'll think of others.

M50 Defense in Depth

. . . And never before such *durable* color. See next page for proof . . .

*Registered trademark of

National Lead Company

General Offices: 111 Broadway, New York 6, N.Y.

For more facts, turn page

A. No visible discoloration from atmospheric conditions

Contrast areas marked **A** in photo (top at right) of paint test panels exposed 18 months. You can see *M50* pigment paint is free of discoloration caused by atmospheric conditions.

B. No objectionable whitening from normal chalking

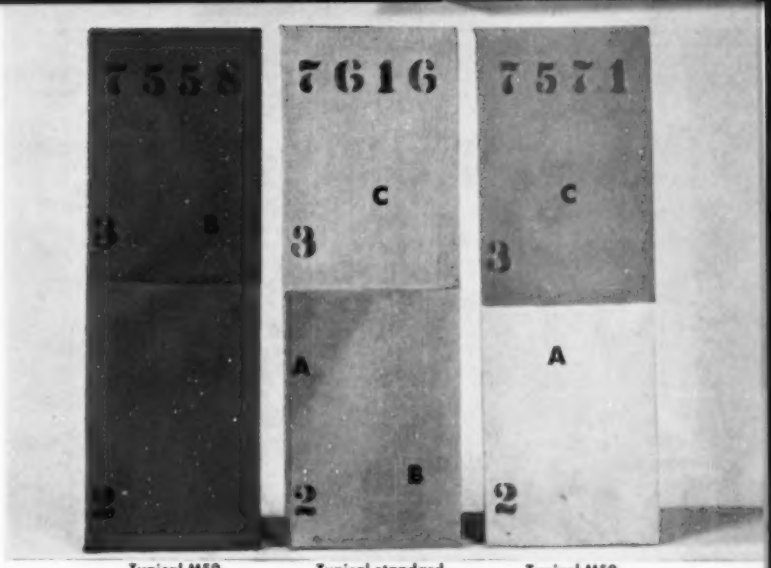
Now compare areas marked **B**. Notice the brightness of color in the *M50* pigment paint. A finger drawn across this paint shows no mark from rubbed off chalk.

C. No noticeable leaching from water action

Look closely at areas marked **C**. Can you see where the non-*M50* paint has been leached by rain water to expose vertical brushmarks in the undercoat? Insoluble *M50* pigment prevents this film failure.

D. No excessive fading from light action

This time examine the close-up (bottom photo at right) of a 9-year *M50* pigment primer exposure test. Contrast between the area shaded by a wooden panel holder and the non-shaded area shows excellent tint retention conferred by *M50* pigment.



Typical M50 pigment paints | Typical standard specification paints | Typical M50 pigment paints

3-mil M50 pigment primer exposed 9 years, 45°S

M50 pigment paint tints stay brighter, retain hue longer ...they're protected against all 4 causes of color loss

No need to amplify what the illustrations on this and the preceding page show. Plainly, *M50** pigment Defense in Depth paints give you more color freedom, more color durability than ever before available in metal protection paints. More rust inhibition, more weather resistance, too. In every coat!

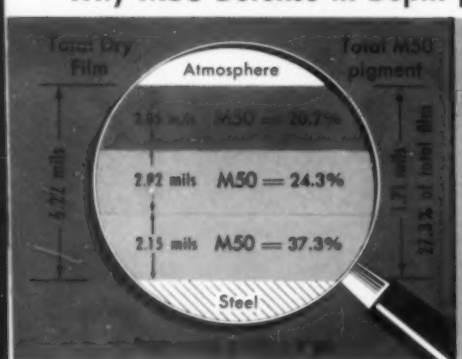
Where to get M50 pigment Defense in Depth paints

National Lead makes the pigment, not the paints. So the place to go for *M50* pigment specification paints themselves is your regular supplier. However, National Lead can help you familiarize yourself with these new paints in four ways: (1) show you *M50* pigment paint exposure test panels at its Sayville, L. I. Test Station; (2) send you a 24-page descriptive brochure, "Defense in Depth." (Mail coupon below); (3) provide technical aid in test applications; (4) help you develop suitable specifications for paints containing *M50* pigment.

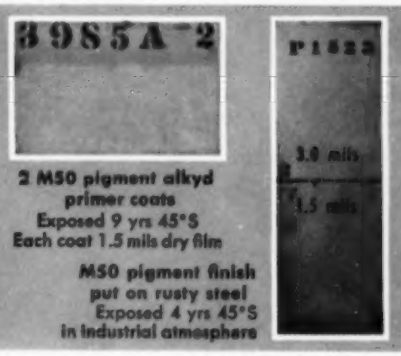
For M50 pigment paints themselves, contact your regular suppliers.

*National Lead Company trademark for a basic lead silico chromate pigment

Why M50 Defense in Depth paints give you metal protection beyond all former concepts



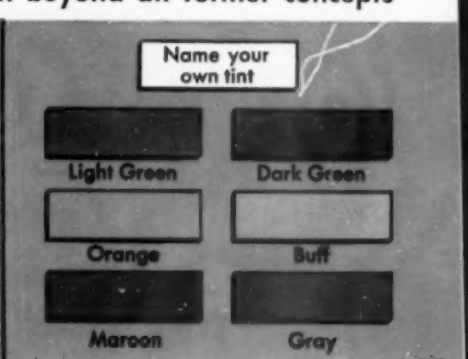
In every coat...rust inhibition! Fused lead chromate is noted for rust-inhibition. The *M50* pigment particle structure permits paint makers to include large proportions of lead chromate in all coats of anti-corrosive systems.



2 M50 pigment alkyd primer coats
Exposed 9 yrs 45°S
Each coat 1.5 mils dry film

M50 pigment finish
put on rusty steel
Exposed 4 yrs 45°S
in industrial atmosphere

In every coat . . . weather resistance! *M50* pigment is insoluble in water and has the excellent tint retention properties of fused lead chromate. Unlike other rust inhibitors, it actually boosts weather resistance of paints.



In every coat...your choice of colors! *M50* pigment gets along well with most tinting pigments, permits paint makers a wide range of colors...not only in intermediates and finishes but in primer coats as well. Colors stay true.

M50 Defense in Depth

National Lead Company,
111 Broadway, New York 6, N. Y.

Gentlemen: Please send me your 24-page brochure, "Defense in Depth." Include color card of the six *M50* pigment paints you recommend for steel highway structures.

Name_____ Title_____

Firm or Dept_____

Address_____

City_____ State_____

REO

No truck is built to more exacting standards of engineering or with more painstaking care in maintaining quality.

Every engine, for example, is meticulously assembled and undergoes a 1½ hour test-stand run. Beyond this, Reo's V-8 engines are dynamometer operated for 3½ hours, then torn down for a thorough top and bottom inspection after which another hour is spent on a dynamometer stand. Once installed in a truck, *every* engine gets an average 12 mile road test.

This is typical of the way important hidden values are built into Reo Trucks. Reo Division, The White Motor Company, Lansing, Michigan.

Gold Standard of Values

Have you tried SEMI-AUTOMATIC HARD-FACING with STOODY WIRES?

Semi-automatic hard-facing is fast taking hold in all industry! Here's a process that *removes much of the labor of welding* and is 2 to 4 times *faster* than manual application. Weldors can see the weld—wires are fed bare; no submerging flux or flux dams are required. Welding is continuous, feeding from layer wound coils...no stub ends, no lost time changing electrodes. With higher speed there is lower heat input, less penetration of the base metal and reduced dilution of deposits...hence higher wear resistance than with manual electrodes of similar analysis.

WHAT CAN YOU HARD-FACE SEMI-AUTOMATICALLY?

Virtually all large parts now hard-faced manually ...crusher rolls, mill hammers, impact crusher rotors, shovel and tractor parts, tool joints, dredge pump impellers and casings, muller tires, etc.

ASK FOR DEMONSTRATION—Most Stoody distributors (check the yellow pages of your phone book) are equipped to demonstrate Stoody Semi-Automatic Hard-Facing *right on your job!* Ask your distributor to arrange a demonstration today!

STOODY SEMI-AUTOMATIC WIRES—Now available in 11 types for *maximum* wear resistance under *every* wear condition!

STOODY COMPANY

11908 E. Slauson Avenue, Whittier, California

. . . for more details circle 322 on enclosed return postal card

New Products

Reader Service Numbers on Enclosed Postal Card

See also pages 87, 90, 94-5, 98, 102 and 103 for more products

Concrete Paving Form

A new paving form, announced by Super Form Co., has a circular sliding lock designed to eliminate sledging and to provide a more rigid joint between rails. It is claimed to assure longer life of forms by eliminating splitting, brooming and bending due to hamming. The locking device consisting of heavy sleeves welded into the ¼ in. triangular brace plates at the ends of the forms, is operated by placing an ordinary form stake in the welded socket, and levering forward to slide the snug-fitting lock pipe into place. An auxiliary locking pin in the lower outside corner is tapped into place to prevent forms from tilting under any conditions. Supports (either 3 or 4 in each form section) are welded to base and top rail.

Super Form Paving Form

Super Form Co., 16 E. Broad St. Columbus, Ohio.

For more details circle 128 on Enclosed Return Postal Card.

Backhoes and Loaders

A completely new line of Ottawa backhoes and front end loaders is now available for various makes and models of tractors, at a lower cost than previous Ottawa models.

The new Model LX backhoe digs to a depth of 12½ feet in any position of 190° continuous arc of swing.

The new Ottawa U loader is stated to lift from ground level to maximum dumping height in 4½ seconds, to dump in 2 seconds, and to lower to the ground in 3 seconds.

Ottawa Model LX—Backhoe

When backhoe and loader are mounted on the same tractor, the Ottawa hydraulic system operates both, providing 2400 lb. loader lifting capacity with 3500 lb. breaking, and 7000 lbs. digging force at cutting edge of backhoe bucket.

Ottawa Steel Division, Young Spring & Wire Corp., Ottawa, Kan.

For more details circle 129 on Enclosed Return Postal Card.

Multi-Purpose Digger

A new, improved "C" digger the "Bobcat", has been introduced by Sherman Products. It has a fast, operating cycle and is said to be extremely stable, particularly when working directly behind the tractor. It digs close to the tractor, permitting easy maneuverability in tight places. Its mounting close to the tractor controls makes it easy for the operator to change tractor positions and adjust throttle settings.

The Bobcat has an 18-in. bell hole shovel, interchangeable with a trenching shovel, and telescoping stabilizers. It can dig 10 ft below grade.

"Bobcat C" Digger

Sherman Products, Inc., Royal Oak, Mich.

For more details circle 130 on Enclosed Return Postal Card.

Levermatic Consolidation Apparatus

Soil Load Testing

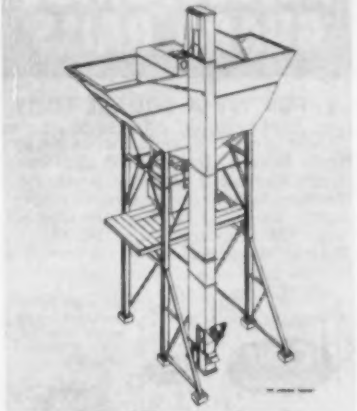
A new and compact soils load settlement device called the "Levermatic" consolidation apparatus has been announced by Soiltest, Inc. Consolidation tests are performed in the laboratory to determine a soils load settlement characteristics with time, the data obtained being used to predict the settlement of a foundation under any structure.

Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill.

For more details circle 131 on Enclosed Return Postal Card.

Transit-Mix Plant

The "Jumbo", the largest of a recently introduced series of Johnson low-cost, packaged transit-mix plants, is designed



Jumbo Transit Mix Plant

for easy erection and high capacity and convenient operation. Aggregate bin is divided into three compartments, can store 105 cu. yd. Cement is held in a 100-bbl overhead tank. The bin shell is of all-welded construction and comes in sections that are simple to put together. The heaviest piece weighs 5½ tons.

The 6-cu. yd. manual Johnson "Hi-Speed" concentric batcher has three 12,000-lb. weigh beams for aggregates and one 5,000-lb. beam for cement. Separate cement and aggregate discharge levers completely control discharge. Maximum premixing and minimum dusting result from cement being discharged within the aggregates.

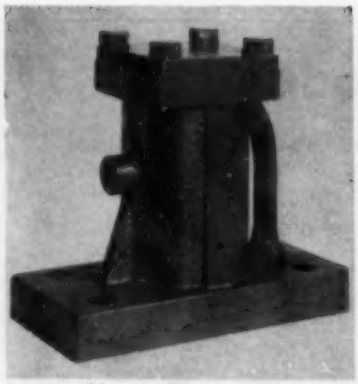
C. S. Johnson Co. (Koehring Co., Subsidiary) Champaign, Illinois.

For more details circle 132 on Enclosed Return Postal Card.

Hopper Air Vibrator

A patented one-piece bin and hopper pneumatic vibrator has been announced by National Air Vibrator Co. It uses no body assembly bolts to shear or stretch, eliminates housing springs that cause replacement, and has an integral striking plat that can't separate and leak air.

The Navco "Binmaster" line of vibrators are made in five different piston sizes for a variety of bin, hopper, chute, railroad car and batching applications.



Navco "Binmaster"

National Air Vibrator Co., 2372 West 7 St., Cleveland 13, Ohio.

For more details circle 133 on Enclosed Return Postal Card.

Rock Drill Chassis

The TDL "Trac-Drill" has been added to the Joy line of self-propelled drill chassis. Designed to carry any one of five Joy "Silver Streak" drifter drills, the TDL permits the selection of a drifter for almost any size and depth blasthole up to 3½ in. in diameter and 40 ft. depth. It also permits the selection of a drill and chassis combination to match the available air supply.

Joy Manufacturing Co., Henry W. Oliver Building, Pittsburgh 22, Pa.

TDL Trac-Drill

For more details circle 134 on Enclosed Return Postal Card.

2-Bucket Aerial Arm

The new "Holan Elbow" is stated to be the first cable controlled aerial arm. It has a maximum ground-to-floor height of 36 ft., 10 in., reaches 31 ft., 4 in. horizontally, and will bend 8 ft., 8 in. below ground level. The mast rotates 360 degree continuously in either direction. Upper and lower arms are controlled by double-acting hydraulic cylinders working in combination with aluminum drive sheaves.

New "Holan Elbow" on Light Maintenance in Cleveland

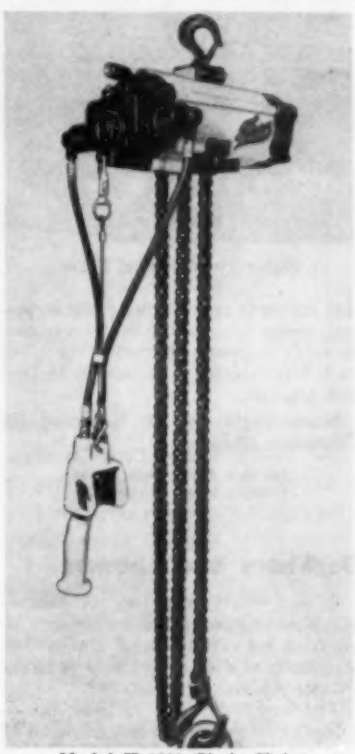
The work buckets, 22 by 22 and 36 in. deep, are made of non-conductive fiber-glass reinforced plastic.

J. H. Holan Corporation, 4100 West 150th St., Cleveland 35, Ohio.

For more details circle 135 on Enclosed Return Postal Card.

Chain Hoist Weighs 30 Lb.

A compact, new, air-operated chain hoist—the model H-1000—announced by Thor Power Tool Co., weighs only



Model H-1000 Chain Hoist

. . . FOR 17¢ A SQUARE FOOT

"Codit" Reflective Liquid goes on fast by brush or spray. Hazards flash their own bright warning at night for safety. Reflectivity lasts up to 2 years. Buy your supply from your 3M Representative or write 3M Company, Dept. NR-68, St. Paul 6, Minnesota.

Get Codit Reflective Liquid in 6 oz. aerosol spray, 5 lb. can, or in complete safety kit.

3M

. . . for more details circle 300 on enclosed return postal card

Three Bucyrus-Erie 54-Bs and a 38-B (in background) keep haul units on the go as they load clay borrow material for the Tri-State Tollway. Two other 54-Bs are working at this location. On another section of the tollway are a Bucyrus-Erie 30-B crane, 38-B clamshell, and 38-B pile driver.

TRI-STATE TOLLWAY Contractors Profit from Bucyrus-Erie Team Action

At Hillsdale, Ill., this 54-B excavates fill for the new roadway. The deep box-section construction of the boom provides great strength with minimum weight. Wide spread feet are built to take the whip of fast operation.

Despite unfavorable conditions in construction of the Tri-State Tollway bypassing Chicago, fleets of Bucyrus-Eries are helping to keep the work on schedule. The Bucyrus-Eries pictured here are digging clay borrow on a section of the Tollway south of O'Hare International Airport.

Excavation at this site amounts to about a million yards. Plans call for turning the resulting pit into a lake for the Maywood Sportsmen's Club after all material has been removed.

Such characteristic Bucyrus-Erie features as low maintenance and day-in day-out dependability help contractors on the Tri-State Tollway get the most for their operating dollars.

See for yourself! Watch Bucyrus-Eries in action. Then contact your nearby Bucyrus-Erie distributor for all the facts. The sooner you do, the sooner you can enjoy the benefits that only Bucyrus-Eries offer! 476E58

It's a full load for this 38-B, equipped with fast loading, smooth carrying, rapid dumping bucket. Bucket castings are made of BECOLOY — a special alloy developed by Bucyrus-Erie — which combines great strength with light weight . . . adds wearing ability and impact resistance.

A Familiar Sign... BUCYRUS ERIE *..at Scenes of Progress*

BUCYRUS-ERIE COMPANY • SOUTH MILWAUKEE, WISCONSIN

. . . for more details circle 246 on enclosed return postal card

30 lb. and can raise half-ton loads at a rate of 50 ft. per minute. It is capable of lowering rates up to 96 ft. per minute under maximum load. Sensitive throttle control permits accurate spotting of loads and infinite graduation of load lifting or lowering rate from crawl speed to maximum speed.

Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

For more details circle 136 on Enclosed Return Postal Card.

Rock Drill

A new air-powered, self-propelled TDM "Trac-Drill" has been announced by Joy Manufacturing Co. Designed to carry the Joy TM-450 drill, the machine is stated to be capable of drilling 3½ in. blastholes to a depth of 40 ft. or more.

TDM "Trac-Drill"

Completely power-operated, the TDM is stated to offer almost infinite range of drilling positions, from the toe hole position of minus 10° at ground level up through vertical and to 45° forward of vertical. Horizontal holes approximately 8 ft. above ground level can be drilled. True verticals can be drilled on a 45° grade, and upholes at any angle up to 45° above horizontal. The feed tilts 15° to either side of vertical, allowing true vertical holes to be drilled on uneven terrain.

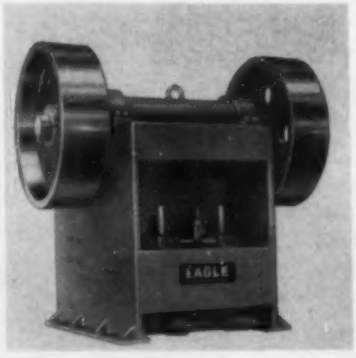
Joy Manufacturing Co., Henry W. Oliver Building, Pittsburgh 22, Pa.

For more details circle 137 on Enclosed Return Postal Card.

30 x 42 In. Jaw Crusher

A new, larger Eagle jaw crusher has a 30 x 42-in. feed opening. According to the manufacturer, it will serve in many cases as a primary crusher. Rated capacity is 125 to 400 tons per hour. Overall weight of crusher alone is 55,000 lb. It requires a 125-150-hp motor to attain and hold normal operating speed of 200 rpm. Crusher jaws are adjustable (while operating) from a minimum of ½ in. to a maximum of 8 in.

Eagle Crusher Co., Galion, Ohio.



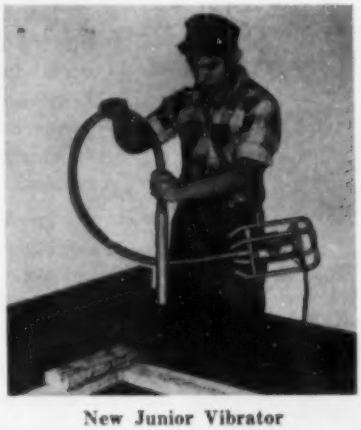
Eagle 30 x 42-In. Jaw Crusher

For more details circle 138 on Enclosed Return Postal Card.

Concrete Vibrator

A new addition to the WYCO "Junior" vibrator line is equipped with a ¾-hp Universal 110 v. motor and is used with 1⅜ in. or 1⅝ in. vibrator heads with either steel or rubber tips. It is light enough to readily be handled by one man, and yet powerful enough to be used with the lowest slump concrete.

Wyzenbeck and Staff, Inc., 223 N. California Avenue, Chicago 12, Ill.



New Junior Vibrator

For more details circle 139 on Enclosed Return Postal Card.

Gas Turbine Tractor

An experimental crawler tractor powered by a high speed Boeing 502-10C gas turbine has been built by Allis-Chalmers Mfg. Co.

The experimental model, named the P-91, is part of the company's continuous program of investigation into heat engines suitable for use in vehicles. The design involves the equivalent of a "built-in" torque converter, which is standard equipment on Allis-Chalmers' model HD-21 crawler tractor. Ability of the turbine to deliver the range of speed and flexibility of power required for successful tractor operation will be thoroughly tested and evaluated.

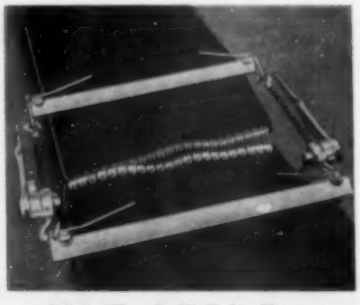
Allis-Chalmers Manufacturing Co., 1956 Thomas St., Milwaukee, Wis.

For more details circle 140 on Enclosed Return Postal Card.

Experimental P-91 Crawler Tractor Powered by Boeing Gas Turbine Engine

New Belt Conveyor Clamp

A heavy-duty clamp, the LS-3, announced by Flexible Steel Lacing Co., is especially designed for long, high tension, conveyor belts. It is stated to greatly simplify installation.



LS-3 "Far-Pul" Belt Clamp

This all-steel device consists of two pairs of clamping bars, each pair made up of three parts: V-bar (angle iron), round "gripping" bar, and draw-up bolt with handle welded to bolt end to speed tightening.

Flexible Steel Lacing Co., 4607 Lexington St., Chicago 44, Illinois.

For more details circle 141 on Enclosed Return Postal Card.

134-HP Crawler Tractor

International Harvester announces the TD-20, a new 134-hp diesel crawler tractor, with full reverse transmission, making six speeds available either for-

TD-20 Diesel Crawler Tractor

MAKE MORE MONEY

POUR MORE CURB WITH LESS LABOR!

Midwest's No. 412 Sliding Curb and Gutter Form entirely eliminates the need of curb face forms . . . permits continuous pouring of integral curb on slab or curb and gutter. Users report substantial savings of both time and money.

PROMPT DELIVERY FROM STOCK

Write for Specifications and Prices

MIDWEST METAL STAMPING CO.
Kellogg 1, Iowa

. . . for more details circle 305

. . . FOR ONLY 35¢

"Codit" Reflective Liquid goes on fast by brush or spray. Hazards flash their own bright warning at night for safety. Reflectivity lasts up to 2 years. Buy your supply from your 3M Representative or write 3M Company, Dept. NR-68, St. Paul 6, Minnesota.

Get Codit Reflective Liquid in 6 oz. aerosol spray, 5 lb. can, or in complete safety kit.

. . . for more detail circle 301

ward or back—1.5-7 mph forward and 1.8-8.4 mph in reverse. Maximum drawbar pull is 27,500 lb. in first gear at 1.5 mph. Tractor gauge is 74 in. and operating weight 29,300 lb.

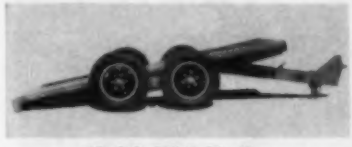
International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

For more details circle 142 on Enclosed Return Postal Card.

Equipment Trailer

A new model CT-7 tandem axle utility equipment trailer, announced by Miller Tilt-Top Trailer Co., features a tandem suspension combined with between-the-wheels platform design to provide a lower climb angle, and lowered height of load equipment. Walking beam action reduces jarring over rough terrain.

Miller Tilt-Top Trailer Co., 450 South 92nd St., Milwaukee 14, Wis.



Model CT-7 Trailer

For more details circle 143 on Enclosed Return Postal Card.

Two-Way Radio

A new hand-carried transmitter-receiver announced by General Electric is expected to have considerable usage in locations inaccessible to radio-equipped vehicles. Sensitivity of the new equipment (0.4 microvolts) will be extremely important in remotely-located areas where communications reception normally is poor.

G-E Transistor No. 3N36, for frequencies up to 100 mc, will be used in the 25-54 mc low-band portable. Units

Hand-Carried Two-Way Radio Set

designed for high-band (144-174 mc) will be equipped with G-E Transistor No. 3N37, for use up to 200 mc.

General Electric Communication Products Department, Electronics Park, Syracuse, New York.

For more details circle 144 on Enclosed Return Postal Card.

TWIN FACTS

a report on the cost-cutting performance of Euclid "Twins"

10 million yd. airfield construction calls for fast production

The first phase of construction of Meridian Naval Auxiliary Air Station near Lauderdale, Mississippi, was awarded to Hyde Construction Company and Cook Construction Company, both of Jackson, Mississippi. The initial contract called for handling 9,700,000 cu. yds. within 360 calendar days — about 50,000 yds. per day figuring 200 work days — with a $500 per day penalty imposed for every day over the time limit. Over 700,000 yds. have been added to the contract since grading operations were started.

With the size of the project and the time limit requiring big, fast production equipment, Hyde Construction put nine Euclid "Twins" on the job. These 24 yd. all-wheel drive scrapers have really been making the dirt fly.

A recent time and weight study showed that the TS-24 "Eucs" were loading 26.4 bank yards in 46 seconds on the average . . . in dead sand! Despite some adverse weather, materials and compaction difficulties, the work has been on or ahead of schedule. Operating two shifts, the contractors moved 65,000 yds. a day during one month.

On farm-to-market roads or big projects like this, Euclid "Twins" are moving the cheapest dirt!

EUCLID DIVISION, General Motors Corp., Cleveland 17, Ohio

. . . for more details circle 277

Diesel Highway Tractor

A new lightweight GMC highway tractor designed to fit any job in the 55,000-lb. and up hauling range has aluminum construction features giving it a curb weight of only 10,450 lb.

The GM 6-71SE diesel engine, developing 189 hp and standard axles give hauling power ratings of 30,000 lb. G.V.W. and 60,000 lb. GCW. Optional engine and axles give ratings of 33,000 lb. GVW and 65,000 lb. GCW. Bumper-to-back-of-cab dimension is only 90 in. which gives a high degree of trailer interchangeability and permits the use of 35 or 40-ft. trailers in 45 and 50-ft. length-limit states. Trailer kingpin settings from 30 to 36 in. stay within the 45-ft. limit without fifth wheel adjustment.

Model D860 Highway Tractor

GMC Truck and Coach Division, General Motors Corporation, 660 South Boulevard, East, Pontiac 11, Michigan.

For more details circle 145 on Enclosed Return Postal Card.

New Light-Weight Trailer

Rogers Brothers Corporation has announced the TVT, "Top Value Trailer", a general utility model with a capacity of 25 tons weighing only 9000 lb. This lightness has been achieved through complete redesigning and the liberal use of high strength alloy steel.

Rogers "TVT" Trailer

A beaver tail extension permits easy loading and the handling of longer loads. The open type bed permits the handling of a variety of loads.

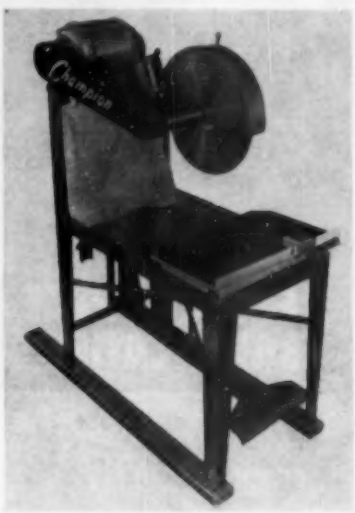
Rogers Brothers Corp., Albion, Pa.

For more details circle 146 on Enclosed Return Postal Card.

Masonry Block Saw

A new 20-in., Model 20 "Blok-Saw," added to the Champion line, enables the operator to saw an 8-in. block in one cut. It is powered by a 1½, 2, or 3-hp engine.

Champion Manufacturing Co., 2028 Washington Ave., St. Louis 3, Mo.



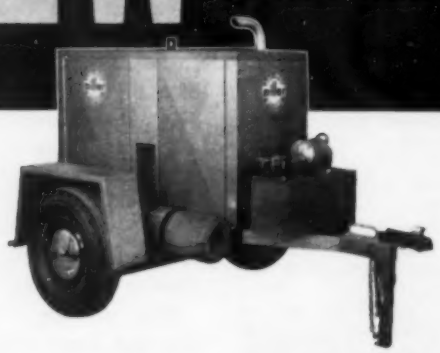
Model 20 Blok-Saw

For more details circle 147 on Enclosed Return Postal Card.

Backhoe Attachments

An 8-ft. backhoe attachment with two bucket capacities for its Speed Swing Loader has been announced by Pettibone Mulliken. The 18-in. bucket has a

NEW DESIGN POWER PERFORMANCE



BIG . . . TOUGH . . . RELIABLE

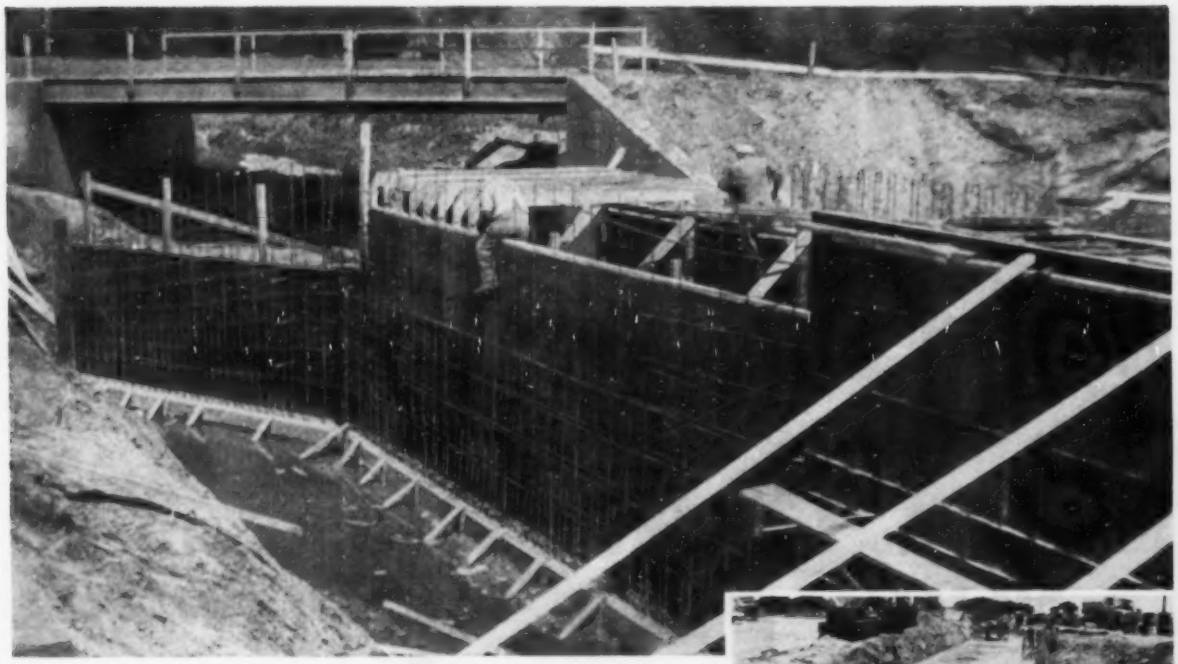
. . . and offered in three models for every "beyond the power line" job:

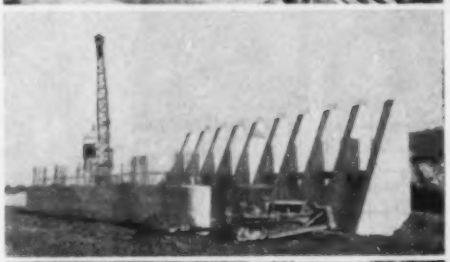
The **ROUSTABOUT** D-250 DC for metallic arc welding
The **BIG RIG** DA-300 AC/DC for metallic arc welding
The **FIREBALL** DAH-350 AC/DC for metallic arc and tungsten inert gas welding

All models have a 10 kw single phase 115/230 volt ac power plant and deliver, while welding, 1 kw of 115 volt dc auxiliary power. Proven Miller ac generator is driven by Hercules engine. Coupled with the revolutionary new Miller semimetallic rectifier, this produces the industry's finest performing dc welding current . . . bar none!

Complete particulars will be sent promptly. Please indicate model in which you're interested. *Address inquiries to J. G. Waldron.*

miller ELECTRIC MANUFACTURING COMPANY, INC.
distributed in Canada by CANADIAN LIQUID AIR CO., LTD., Montreal • APPLETON, WISCONSIN
. . . for more details circle 306 on enclosed return postal card





forming Bridges, Culverts, Piers?

UNI-FORM *PANELS*

Save LABOR, MATERIAL, TIME!

Simple mechanical assembly and pre-engineered techniques for handling virtually any forming condition make UNI-FORM Panels your best bet for fast, low cost forming. Successful contractors everywhere are using the UNI-FORM system to form bridges, overpasses, culverts, piers and abutments, because their experience has shown that UNI-FORM Panels give them the speed, flexibility and economy required to handle this complex type of forming at the lowest possible cost.

Let us prove our point. Send a set of plans for detailed forming specifications, recommendations and cost analysis. There's no obligation, of course.

P1501

UNIVERSAL FORM CLAMP CO.

Concrete Form Specialists Since 1912

1238 North Kostner Avenue, Chicago 51, Illinois

BRANCH OFFICES AND WAREHOUSES

SAN LEANDRO, CAL. 2051-9 Williams Street	LOS ANGELES, CAL. 13210 S. Figueroa Ave.	HOUSTON, TEX. 2314 Preston Ave.
CLEVELAND, OHIO 24901 Lakeland Blvd.	BALTIMORE MD. 1020 N. Kresson St.	ATLANTA, GEORGIA 1401 Howell Mill Rd., N.W.

Here Are The Basic Elements:

. . . for more details circle 332 on enclosed return postal card

Backhoe Attachment on Loader

⅛-yd. capacity; the 24-in., ½ yd. Digging depth is 8 ft. 6 in. and the surface reach is 12 ft. 6 in. from front of tires. The loading height, from tires, is 11 ft.

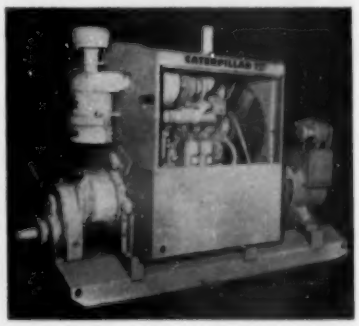
Pettibone Mulliken Corporation, 4710 West Division St., Chicago 51, Ill.

For more details circle 148 on Enclosed Return Postal Card.

Engine With Generator

The Caterpillar D337 (Series F) engine here shown is equipped with an electric generator at one end of its crankshaft and delivers take-off power at the other. It is adapted for crusher, dredge, or drill rig service. Says the manufacturer, "It is a new method of applying one engine to a number of applications that formerly required two. We feel that the use of this engine arrangement will have a definite impact in the rock crusher powering field where mechanical energy is needed for powering jaw and drum crushers and electrical energy is best used in powering conveyors, screens and elevating wheel." The rating is 310 maximum hp.

Caterpillar Tractor Co., Peoria, Ill.



Caterpillar D-337 Series F Engine

For more details circle 149 on Enclosed Return Postal Card.

New Digging Bucket

A choice of bucket styles to fit job requirements is now offered on Model 1000 Case "Terra-Trac" Crawler tractor-shovels. In addition to the front-hinged bucket with extra-high dump clearance, a new rear-hinged bucket is now available on the 100 hp model for heavy-duty digging. Both buckets are

Rear-Hinged Bucket on Model 100 Case Terra-Trac Tractor-Shovel

rated at 2 cu. yd. capacity. However, the new rear-hinge design has more than 25% greater breakout force, and about 600 lb. greater carrying capacity for handling heavy materials. It also is wider, shallower, and has a steeper grading angle. Price is about 13% higher than the front-hinged design.

J. I. Case Co., Racine, Wis.

For more details circle 150 on Enclosed Return Postal Card.

Crawler Tractor Backhoe

In addition to a new type rotary swing cylinder with 200 degree continuous arc, the new Henry Mark III

Announcing the NEW CLARK LINE of

BINS and BATCHING PLANTS

CLARKLINE One or Two Stop Batchings Plants feature unitized shipping assemblies for low cost erection and high portability. Available with either manual or push button automatic controls. Capacities and specifications to meet any requirement for permanent or special contract installations.

ROAD and AIRPORT FORMS
with Exclusive . . . . . .

NOW form setting time reduced to a minimum with CLARK WEDGE-LOK*, the EXCLUSIVE method of form joint. No movement of the form will occur during staking and wedging operation. Further adjustments can be made by use of the double wedge keys in the stake pockets. *PATENT PENDING

CLARK INDUSTRIES
CONSTRUCTION EQUIPMENT DIVISION

SEE YOUR LOCAL DEALER OR WRITE FOR LITERATURE

375 EAST FIFTH AVENUE • COLUMBUS, OHIO

A UNIT OF CLARK GRAVE VAULT COMPANY

. . . for more details circle 262 on enclosed return postal card

Henry "Mark III" Backhoe

Backhoe mounts close to the rear of the crawled tractor with a quick detachable mounting requiring only two pins. It digs to a maximum of 12 ft. 6 in. with a loading height of 8 ft. 6 in. Two individually controlled hydraulic out-riggers with a span of 9 ft. 8 in. provide stability.

Available are 12 different bucket sizes, ranging in width from 12 to 38 in., plus 4 different sized mole's paw buckets, and a pipe pusher attachment.

Henry Manufacturing Co., Inc., P.O. Box 521, Topeka, Kan.

For more details circle 151 on Enclosed Return Postal Card.

Rotary Air Compressor

The new LeRoi 365RD2 is a portable, two-stage, oil-cooled, sliding vane type compressor, rated at 365 cfm of free air compressed to 100 psi, operating at a compressor speed of only 1100 rpm.

Le Roi 365 RD2 Portable Compressor

The compressor is coupled to a GM 471 diesel engine with a hydraulically actuated clutch. Engine speed at rated output of compressor is 1650 rpm. A 100% capacity control matches air supply to the air demand within a pressure range of 10 psi. Supporting frame with a 3-point suspension protects the unit against damage from towing distortion over rough terrain.

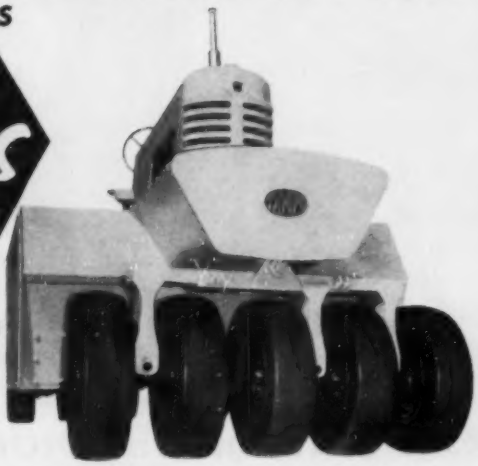
Sales Promotion Department, Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin

For more details circle 152 on Enclosed Return Postal Card.

FASTER PRODUCTION!

WITH TAMPO'S GREAT,

NEW SP-11S



- ASPHALTIC MATS
- SEAL COATS AND SCREENINGS
- STABILIZED SOILS
- EMBANKMENT AND FLEXIBLE BASE

88 inch rolling width, torque converter, power operated reversing clutches and speeds to 22 m.p.h. make the Tampo SP-11S the most efficient black top roller.
Seal coat rolling at 12 m.p.h.—keep up with modern spreaders. Write for latest bulletin.

TAMPO MANUFACTURING COMPANY

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SAN ANTONIO, TEXAS • PHONE: PE-3-9171

. . . for more details circle 329 on enclosed return postal card

One of three ARROW MOBILE HYDRAULIC HAMMERS, owned by a Los Angeles area contractor, tamping trench backfill.

CONTROLLED IMPACT

Automatic Stroke

Creeper Drive

For Compacting to Critical Specifications

With an ARROW MOBILE HYDRAULIC HAMMER, you can control the force of your compacting blows; from gentle, earth-packing pats to as much as 8,000 foot pounds per blow. Compacting specifications can be met with very light vibration and complete safety to sub-surface structures. Prove this to yourself—whether your job is compacting, breaking concrete, cutting asphalt or driving posts or piling—ARROW MOBILE HYDRAULIC HAMMERS are your best buy.

ASK YOUR DEALER FOR A DEMONSTRATION

Arrow Manufacturing Company

196 WEST DAKOTA DENVER, COLORADO

. . . for more details circle 237 on enclosed return postal card

SAND BLAST the easy RUEMELIN way!

A practical Sand Blast Generator for all types of outdoor cleaning work. Removes rust scale, paint. Cleans bridges, removes laitence from cement. Cleans ready-mix trucks and highway equipment prior to re-painting. Equipped with remote control with deadman valve for stop and start *at the nozzle!* Wet type nozzles also available if desired. Portable units can be equipped with hi-speed mountings for highway trailing. Write for descriptive bulletin.

RUEMELIN MFG. CO.

MFRS. & ENGRS. • SAND BLAST & DUST COLLECTING EQUIPMENT
3990 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

. . . for more details circle 314 on enclosed return postal card

AB-9403-14

IT'S THE NEW MEZURMATIC TAPE RULE BY LUFKIN!

A new automatic rewind lets you bring back the blade at the speed you want . . . controlled by an exclusive "ball-bearing" governor. When you want to rewind the blade, just press the big button. Release the button . . . the blade stops instantly . . . and it will not "creep". See the new Mezur-Matic on display now at your hardware store. It comes in the standard White Clad® blade or the all-metal Chrome Clad® blade.

THE LUFKIN RULE COMPANY
TAPES • RULES • PRECISION TOOLS
SAGINAW, MICH. • MIDDLETOWN, N.Y. • BARRIE, ONT.

. . . for more details circle 298 on enclosed return postal card

Manufacturers' Literature

"MODERN COMPACTION METHODS AND EQUIPMENT": A 52-page booklet from Bros, Incorporated, 1057 Tenth Ave., S.E., Minneapolis 14, Minn. Besides a general introductory chapter, nine separate articles by specialists discuss rolling, vibratory compaction, and various treatments of natural soils and bituminous mixtures. A 2-page glossary concludes the publication.

For more details circle 153 on Enclosed Return Postal Card.

HIGHWAY TRUCK TIRE DATA BOOK (42 pages) published by B. F. Goodrich Tire Co., Akron, O., lists and describes nine main factors within the control of truck owners and operators which determine the degree of service that will be received from tires. These factors are: (1) tire selection, (2) mileage booster plan, (3) inflation, (4) loads and load distribution, (5) mechanical irregularities, (6) matching and spacing of duals, (7) tire rotation, (8) rims and (9) retread before failure. The book also lists and describes the complete line of B. F. Goodrich tires, suggests safety rules to follow when servicing truck tires, and carries tables on load and inflation and weights and measures.

For more details circle 154 on Enclosed Return Postal Card.

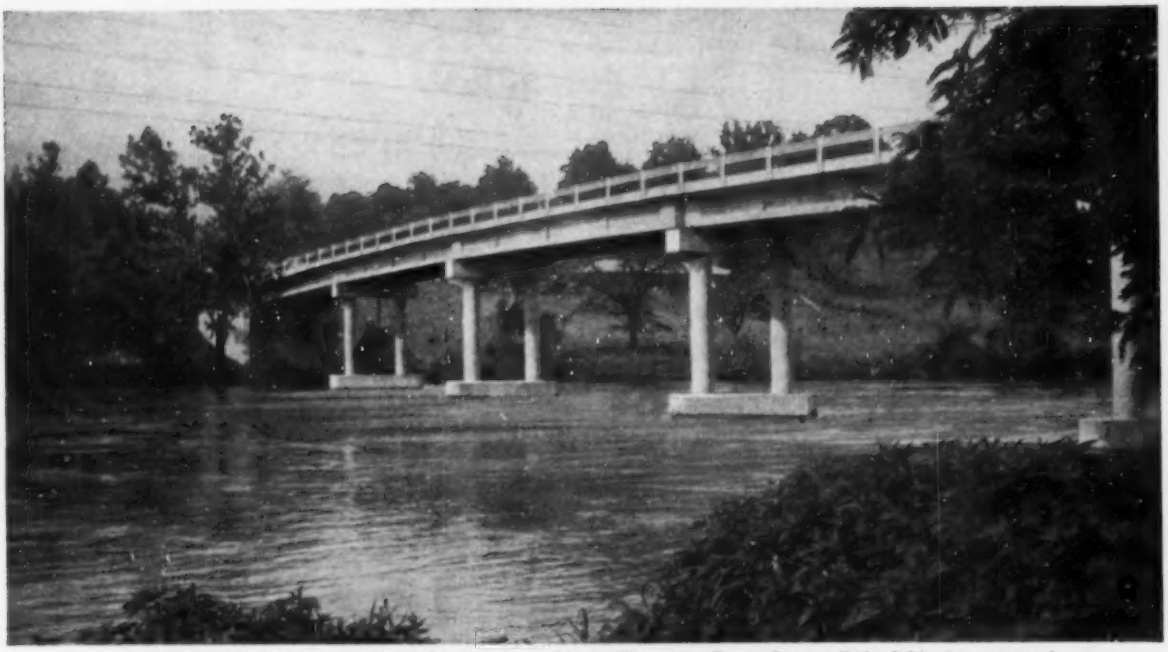
EAGLE IRON WORKS, Des Moines, Iowa has just issued a 48-page catalog of aggregate washing and classifying equipment. Completely comprehensive, it includes descriptions, specifications, and general and detail illustrations. Six pages are devoted to log washers, ore washers, and heavy-media separation plants.

For more details circle 155 on Enclosed Return Postal Card.

REAR AXLES: International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. has issued a 4-page catalog describing its new line of truck-built heavy-duty rear axles—both single reduction and two-speed, designed specifically for handling from 50,000 lb up to the maximum gross combination weights permitted by legal limitations for tractor-trailer highway operations in any state, and up to 30,000 lb gross vehicle weights for off-highway applications. The catalog contains a unique 2-page cross-sectional view of the new single-reduction axle. Ask for Form CR-320-H.

For more details circle 156 on Enclosed Return Postal Card.

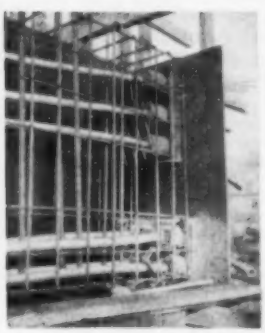
DOW CHEMICAL CO., Midland, Mich., offers a new booklet on control of roadside weeds and brush. "This Way to



South Fork Bridge over South Fork of Holston River, Kingsport, Tenn. Owner: Ridgefields, Incorporated. Contractor: Blount Bros. Construction Company, Montgomery, Ala. Consulting Engineer: Mr. H. T. Spoden.

450-Ft. Prestressed Concrete Vehicular Bridge Uses 53 Miles of Roebling Prestressing Wire

Grouting 90-foot girders.



Detail of end reinforcement cage, Freyssinet end anchorages, metal sheath and Roebling wire—90-foot girder.

Spanning the South Fork of the Holston River at Kingsport, Tennessee, this new bridge embodies the Freyssinet cable method of prestressing. These Freyssinet cables—as well as end anchorages, sleeves, grids, and jacking and grouting equipment—were supplied by the Intercontinental Equipment Company, Inc.

Span lengths are 85, 90, 100, 90 and 85 feet, for a total length of 450 feet. Roadway width is 20 feet between curbs. Prestressing units consist of 8 cables of 18 wires each in the 100-foot span, and 7 cables of 18 wires each in the 85- and 90-foot spans. Wire diameter is 0.196 inches.

Roebling is now equipped to deliver cable assemblies composed of a specified number of wires cut to the required length and assembled in flexible metal hose ready for placement in the forms of post-tensioned members.

This facility is, of course, in addition to the standard 7-wire, stress-relieved strand for pre-tensioned bonded prestressed concrete and galvanized strand assemblies for structures where design loads are heavy or require long tensioning elements, and stress-relieved wire for all types of parallel wire cables for post-tensioning.

Further, Roebling is always ready to furnish you with information and assistance on *any* phase of this remarkable and widely growing construction method. By writing to Construction Materials Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, you can avail yourself of prestressed concrete information on whatever aspect most concerns you.

ROEBLING

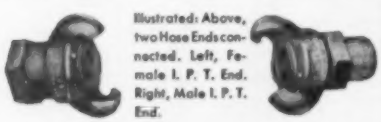
Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

. . . for more details circle 312 on enclosed return postal card

"AIR KING"
Quick-Acting, Universal
HOSE COUPLING

FOR COMPRESSORS, ALL TYPES OF AIR TOOLS, WATER, OIL AND SPRAY SERVICE

This versatile coupling is built along plain, rugged lines to assure long, trouble-free service under severest working conditions.



Illustrated: Above, two Hose Ends connected. Left, Female I. P. T. End. Right, Male I. P. T. End.

The "Air King" will reduce operating costs wherever quick connections are required. Locking heads are identical for all sizes of hose or threaded ends, permitting the coupling of any two sizes of hose within the "Air King" hose end size range, or coupling to any pipe up to 1" by use of the male or female threaded ends. Heads are locked by pressing together and applying a quarter-turn. A patented Safety Locking Device eliminates all risk of the coupling coming apart. Available in bronze or rustproofed malleable iron, in sizes up to 1".

The "Air King" is made to established standards for couplings of this type and is interchangeable with other similar makes.

Also available in 4-Lug style, Hose and Female I.P.T. Ends only, in 1¼", 1½" and 2" sizes.

DIXON
Valve & Coupling Co.
EXPORT DEPARTMENT
1010 SCHAFF BLDG.
PHILADELPHIA 2, PA., U.S.A.

. . . for more details circle 264 on enclosed return postal card

More Miles of Attractive Roadsides at Lower Cost". Seven specific products are listed for use on different types of growth and under different conditions. One state reported that by using a combination mowing and chemical application program they were able to realize better weed and brush control at only two thirds the cost of mowing and cutting.

For more details circle 157 on Enclosed Return Postal Card.

"The Only Safe Pavement Is a Bare Pavement": With this theme, International Salt Co., Scranton, Pa., presents its 28-page booklet, "Bare Pavement Maintenance", dealing with the effects of salt on road safety, methods of salt application, economics, and public relations.

For more details circle 158 on Enclosed Return Postal Card.

Blast Hole Drilling Tools, 12-page bulletin prepared by Brunner & Lay, Inc., 9300 King St., Franklin Park, Ill., gives detailed specifications covering their complete line of carbide drill bits, drill steel, couplings, adapters, extension steel, etc., plus application data.

For more details circle 159 on Enclosed Return Postal Card.

Nylon Cord Construction is being offered for the first time in a standard line of truck tires by The General Tire & Rubber Company of Akron, Ohio. The line is the "Traction Rib Special Service", a new product announced several months ago as a tire that would give 10% greater original mileage than the tire it replaced, with no change in price. It is also made in rayon, which will retail somewhat lower.

For more details circle 160 on Enclosed Return Postal Card.

Schield Bantam Company, Waverly, Iowa, has released a new 4-page bulletin covering materials-handling applications for the company's 7-ton, self-propelled crane excavator, the CR-35. Twelve actual job case histories are presented, and cost-cutting procedures are noted. Ask for bulletin No. AB-158. For complete specifications on the CR-35, ask for bulletin No. CR-502.

For more details circle 161 on Enclosed Return Postal Card.

Soiltest, Incorporated, 4711 West North Ave., Chicago 39, Ill., has just issued catalogs on its concrete tester, model CT-711 for cubes up to 6 in., cylinders up to 7 in., and beams up to 40 in.; its "Stabil-Therm" ovens and "Magi Whirl" baths; and a single sheet covering the "Hi-Lo" detector and dye marking attachment for pavements, the CT-386 Kelly ball, the CT-158 concrete air indicator, and the pocket penetrometer Model CL-700.

For more details circle 162 on Enclosed Return Postal Card.

"For Tough Jobs Ahead" is the title of a 12-page brochure of short, illustrated reports from Caterpillar owners and operators in various parts of the country. Obtainable from Advertising Division, Caterpillar Tractor Co., Peoria, Ill. Ask for Form No. D 816.

For more details circle 163 on Enclosed Return Postal Card.

A Dry Ballast for Tires, the manner of its use, and its effects on road construction and maintenance are described in Bulletin 857 recently issued by "Led" Ballast, Inc., Boulder, Colorado. Unlike liquid tire fillers, "Led" Ballast is compressible, being a specially formulated mineral compound mixed with air. It weighs about 20 lb. per gallon, or more than twice as much as liquid solutions. Mixtures of lower gravity are available.

For more details circle 164 on Enclosed Return Postal Card.

"Truck and Trailer Size and Weight Restrictions", the 1958 edition of a pocket-size booklet compiling the laws of all 48 states and the District of Columbia regulating size and weight of trucks and trailers, has been prepared by the research department of the Four Wheel Drive Auto Company, Clintonville, Wisc. and is available on request.

For more details circle 165 on Enclosed Return Postal Card.

Holan Corporation of Georgia, Everee Inn Road, Griffin, Ga., has just published a 4-page illustrated brochure about its new "Mark C" all-purpose commercial service bodies. Applications are shown to ½- to 1½-ton chassis.

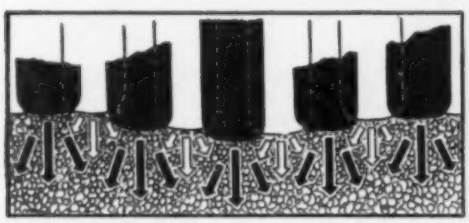
For more details circle 166 on Enclosed Return Postal Card.

Worthington Corporation, Harrison, N. J., has issued bulletins covering its new models 7M and 10M self-priming centrifugal contractors' pumps. Charts show dimensions of the pumps and tables give pump performance data and information regarding the engines.

For more details circle 167 on Enclosed Return Postal Card.

Tractors and Motor Dumps: A new 14-page catalog (MS-1251), available from Construction Machinery Division, Allis-Chalmers Manufacturing Co., Milwaukee 1, Wisconsin, U.S.A., describes operating advantages and engineering features of the HD-6 diesel powered crawler tractor. Specifications are given. Numerous graphs and charts, catalog views of tractor's principal components and a cutaway view of the entire tractor are included.

How oscillating wheels can save you untold street maintenance costs...



See the flow of compaction effort that the BROS Self-Propelled roller **with torque converter drive** provides for street seal coating, resurfacing and shallow lift compaction...

Here's how it is helping cities throughout the country make great savings in street maintenance costs:

- With full oscillation of all wheel pairs to provide uniform compaction, the BROS SP-54 helps "key" and "lock" aggregate materials tightly in the base course to prevent various pavement failures.
- Wheel oscillation of this roller also kneads the asphalt into a tight, solid surface, eliminating hairline cracks that would otherwise turn into surface breaks. Very important, too, rubber tire rolling correctly imbeds the wearing course chips *without* crushing them.
- Besides such proven advantages, the BROS SP-54 offers these time-saving performance features: a torque converter drive provides smooth, easy handling and eliminates "tipping" of chips when starting; it also lessens drive line strain.
- Full-reversing type transmission with shuttle gear permits rolling in either direction without shifting; turn arounds are thus eliminated.
- Infinite speed range from 0 to 18 mph; positive chain drive to both rear wheel pairs; 50 HP engine and smooth, hydraulic steering provide fast, proper compaction results that you can't get from any other roller. See a BROS Distributor or write us for full information and/or a demonstration.

Find out, too, about the complete BROS TEAM. With the SP-54, the BROS Preparator and Roto-Mixer make the perfect combination for low cost street construction. The Preparator (in-place materials reducer) reduces native over-size materials and old blacktop to proper roadbed sizes. The Roto-Mixer stabilizes and blends the base and wearing course materials to improve load bearing values.

75TH YEAR

ROAD MACHINERY DIVISION

BROS INCORPORATED

(Formerly the WM. BROS BOILER & MFG. CO.)

1057 Tenth Ave. S.E. • Minneapolis 14, Minnesota

BROS

. . . for more details circle 244 on enclosed return postal card

Another Allis-Chalmers catalog (MS-1269) describes design features of the TW-360 bottom-dump motor wagon. Action photographs, catalog views, and specifications are included; and production advantages are noted.

For more details circle 168 on Enclosed Return Postal Card.

FILM ON MICHIGAN TRACTORS: The Construction Machinery Division of Clark Equipment Company, Benton Harbor, Mich., has released a new motion picture called "Bonus Loads" to all "Michigan" distributors in the U. S. and Canada. The 16-mm, 22-minute color-sound movie highlights the design and operating features of the "Michigan" line of Tractor Scrapers.

For more details circle 169 on Enclosed Return Postal Card.

THE OLIVER CORPORATION, Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio, has issued new specification sheets for the following equipment: Industrial Wheel Tractors, Super 55, Super 66, Super 77, and Super 88; Super 66 and Super 77 with Danco Rotary Mower; Models 77 and 998 Loaders on wheel tractors; Models OC-46, OC-126, and OC-156 loaders on crawler tractors; Model CT-18F Trail-builder; Model HT-18 and HT-615 Angledozers; Model 990 Scraper; Models OC-6 and OC-15 Crawler Tractors; the Super 225-D Power Unit; the Oliver "Power-Pak." New special bulletins are "The Jobs You Can Do With The Oliver OC-4;" "Modern Methods and Equipment in Sanitary Land Fills;" "Oliver Power Units for Engine-Driven Equipment."

For more details circle 170 on Enclosed Return Postal Card.

How Power Performance On Railway Maintenance-Of-Way Equipment

can help you select the right mower engine

Doesn't it make a lot of sense to take a tip from the men who supervise men and machines? Supervisors of maintenance-of-way equipment . . . professional railroad men . . . know the importance of unfailing engine power. They know that Wisconsin Heavy-Duty Air-Cooled Engines work day after day, month after month with minimum servicing . . . operating in many cases many miles from the facilities of a service shop. Wisconsin Engines are *first choice* in the railway maintenance field.

While you may never give your mower engine the rough, punishing treatment a Wisconsin gets on railway maintenance assignments, it's good to know your Wisconsin is built to take it season after season, delivering the most heavy-duty service with a minimum of servicing. Your men go to work and *stay* until the job is done. The manhours you pay for become *work hours* when your mower is Wisconsin-powered. Write for bulletin S-223, today, describing all Wisconsin Engines.

2,000 service stations . . . several near you!

WISCONSIN ENGINE POWER

first choice of professionals.

MOST H.P. HOURS

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

A8-6170

. . . for more details circle 338 on enclosed return postal card

GOODRICH SERVICE MANUAL. How equipment operators and owners can get maximum service from off-the-road tires is described in a 52-page handbook just published by B. F. Goodrich Tire Co., Akron, Ohio. Factors discussed are: load, inflation, operation conditions and tire care. Included are data on load and inflation, weights and measures, tire specifications for 1957 motor graders, self-propelled scrapers and tractor-drawn scrapers plus valve and rim information.

For more details circle 171 on Enclosed Return Postal Card.

AIR HOISTS: A new 4-page bulletin (No. 2367), available from Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill., illustrates and describes the new Thor H-1000 air hoists.

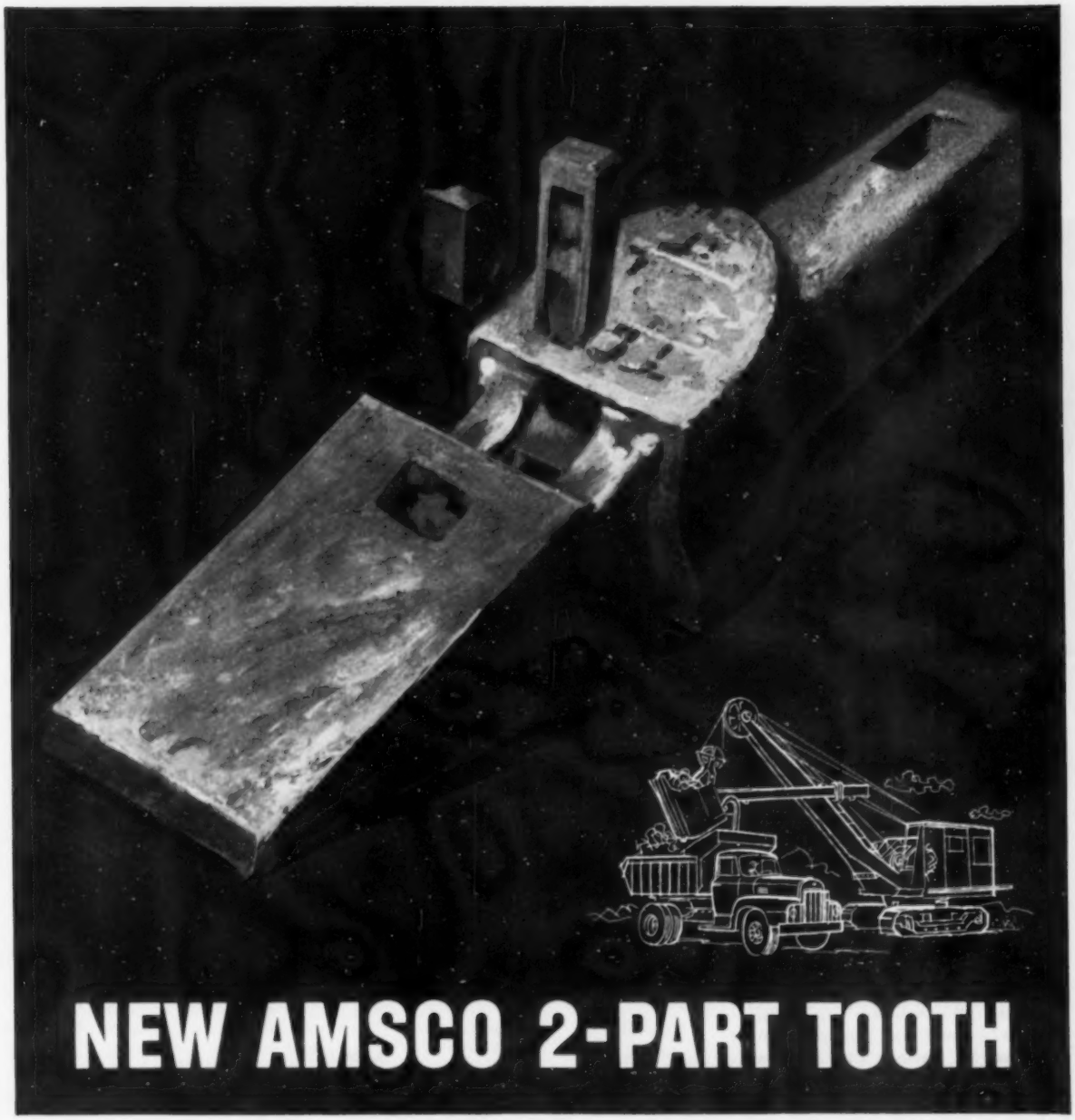
For more details circle 172 on Enclosed Return Postal Card.

GASOLINE ENGINE BULLETINS: Two revised two-page bulletins describing, respectively, improved two-cylinder and four-cylinder air-cooled gasoline engines have been issued by Hercules Motors Corp., 101 Eleventh St., Canton, Ohio. In addition to detailed, illustrated descriptions, the new bulletins include basic installation diagrams and a power chart indicating rating, torque, and performance characteristics with which ratings can be determined under varying conditions in a number of applications.

For more details circle 173 on Enclosed Return Postal Card.

ATLAS COPCO has announced Leaflet E-864-b describing its new LSB-65 portable drill steel grinder, powered by compressed air. A photo sequence in the leaflet demonstrates operation of the new unit. Ask Atlas Copco Eastern, Inc., Paramus, New Jersey, and Atlas Copco Pacific, Inc., San Carlos, Calif.

For more details circle 174 on Enclosed Return Postal Card.



NEW AMSCO 2-PART TOOTH

Special-alloy reversible tips *(easy to reverse)* nearly double tooth digging life...

In quarry work, in cold and hot slag pits... in the roughest of digging tests, these new Amsco® 2-part Simplex teeth have outlasted competitive 2-part teeth more than 2 to 1... at a big saving in tip and adapter replacement time.

You get this longer wearing quality because of the special, rugged alloy used for both tip and adapter. Reversing tips extends digging life even more, yet takes only a few minutes.

Adapters outlast several sets of tips, are equally easy to replace. Pin lock between tip and adapter seats and locks so securely, metal-to-metal, that even side blows can't jar it loose.

We'll be glad to send you a booklet containing reports by Simplex users and describing this new Amsco tooth completely. Write for it today.

American Brake Shoe Company

AMSCO

American Manganese Steel Division · Chicago Heights, Illinois

... for more details circle 235 on enclosed return postal card

Bituminous Articles

Rubberized Asphalt Experiments in Wyoming and Montana

● **Figure 5. "Ant's-eye" view of stone chip being pulled loose from rubberized asphalt seal coating on Montana test one year after completion of job. Remarkable tenacity and ductility of the rubberized cutback are readily apparent.**

New methods of measuring chip retention and evaluating wear under traffic have been developed during the study of these surface treatments.

By F. B. Odasz and R. V. Witter
Husky Oil Company, Cody, Wyoming

"How is the rubberized asphalt holding up?"

"Can you see any difference between rubberized and unrubberized asphalts on seal-coated roads or airstrips?"

These questions are invariably asked when seal coatings are being discussed by airport and highway engineers, state highway department representatives, officials of the Bureau of Public Roads, and road contractors. These people ask such

Table I

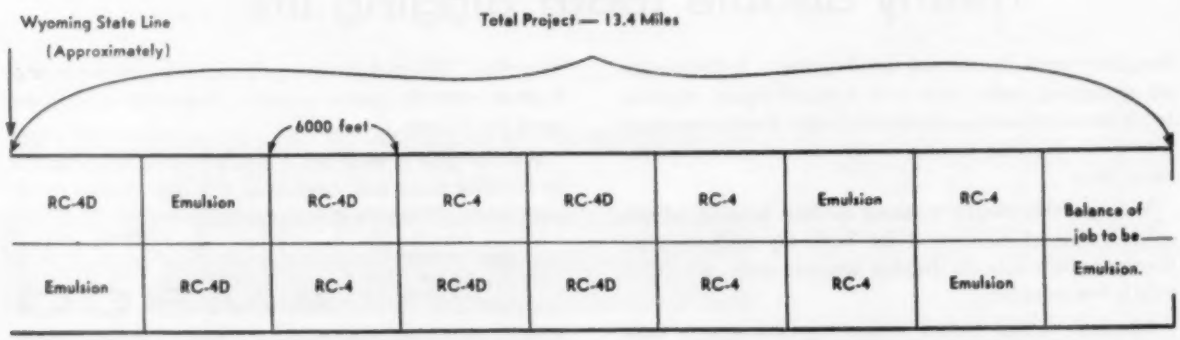
NUMBER OF CHIPS LOST PER SQUARE FOOT

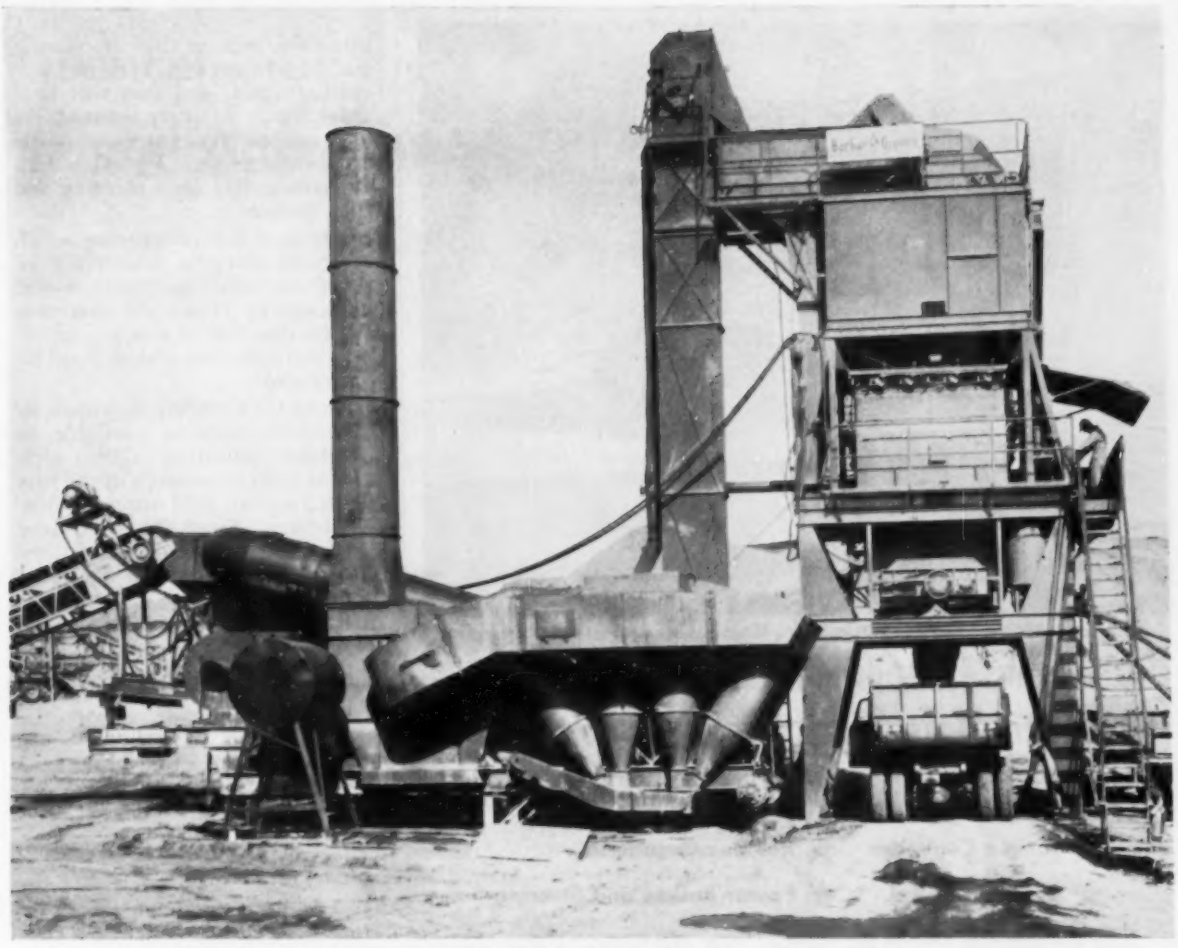
	Wyoming Experiment				Montana Experiment			
Position	Curved Area		Straight Area		West Lane		East Lane	
Material Used	RC-3D	RC-3	RC-3D	RC-3	RC-4D	RC-4	RC-4D	RC-4
Aug. 31, 1955	0	0	0	0	---	---	---	---
Sept. 14, 1955	108	24	15	63	---	---	---	---
Mar. 15, 1955	159	159	86	210	---	---	---	---
Sept. 7, 1956	321	336	103	240	0	0	0	0
Sept. 9, 1957	341	645	229	299	32	187	75	235

AVERAGES

	Wyoming		Montana	
	RC-3D	RC-3	RC-4D	RC-4
After 1 year	212	283	54	211
After 2 years	285	472	---	---

Figure 1.





San Ore Construction Company's 6000-pound Barber-Greene Model 896 BatchOmatic, which has been set up at four widely scattered job-sites. Write for your copy of clearly illustrated *Principles of the BatchOmatic.*

Fast, low-cost moving . . . another BatchOmatic advantage

In its relatively short life this 6000-pound Barber-Greene BatchOmatic has worked on four widely scattered paving jobs. The fact that San Ore Construction Company could move this plant over the highway for these jobs is proof of the superior portability of the BatchOmatic.

The plant was initially set up at Caldwell, Kansas, where it produced mix for Sections 1 and 2 of the Kansas Turnpike. It was then moved about 200 miles to Ellsworth, Kansas, for another road project. The next and longest hop was about 500 miles to Fairplay, Colorado, for paving the upstream face of Montgomery Dam, a job that totaled only 20,000 tons. Its final move of the season was about 100 miles to Fountain, Colorado, for a highway resurfacing project.

Besides their unmatched portability, Barber-Greene BatchOmatics offer:

- Simultaneous measuring of all sizes of aggregate.
- Instant changeover from automatic to manual operation, and from manual to automatic.
- New Dyna-Mix Pugmill which gives thorough coating in less time than any other pugmill.
- Instant, positive inspection of aggregate gradation and weight.

Write for information on the world's most modern asphalt paving equipment. 58-3-AL

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

. . . for more details circle 241 on enclosed return postal card

Rosco Roller owned by Jay W. Craig Co., Minneapolis, on job at Aitkin, Minn.

Increase Operator Efficiency and Produce More Work Per Hour with the ROSCO ROLLER SR-9-T2

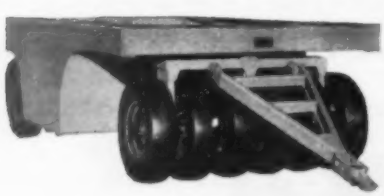
★ Torque Converter ★ Reverse-Omatic Drive

★ Constant Speed ★ Power Brakes and Steering

With this improved 9 wheel self-propelled roller your operator can surface nearly a 6 foot width at working speeds up to 15 MPH. The torque converter and Reverse-Omatic clutch and transmission eliminate scuffing of the surface. Power steering and a throttle setting device that returns to manual at a touch reduce operator fatigue and produce more work per hour.

A modern large-bore, short-stroke engine produces a surplus of power and travel speeds to 30 MPH. Water compartments are integral with the body and other components are set low for safe center of gravity and operator visibility. These features and Rosco's quality construction make the SR-9-T2 a solid investment and profit maker.

Rosco Roller SR-9-T2 with water attachment



Models CR9 and CR13

9 or 13 wheel tow-type rollers, 90 and 120 cubic feet capacity.

ROSCO MINNEAPOLIS

ROSCO MANUFACTURING CO.

3118 SNELLING AVE. • MINNESOTA 6, MINNESOTA

. . . for more details circle 313 on enclosed return postal card

questions because they are continually searching for a better sealcoating agent, one that will hold chips firmly in place, protect the undersurface from water and weathering, and present a good overall appearance free from bleeding and slick surfaces.

Evidence is accumulating which indicates that the rubberized asphalt cutbacks introduced several years ago by Husky Oil Company can be classified as a new material of construction satisfying these requirements.

Husky Oil Company first made its rubberized cutbacks available in unlimited quantities in 1954 after several years of research in the rubberized asphalt field using the Benson process. Since that time these cutbacks have been used in increasing amounts to seal 580 miles of test sections and highway projects in the states of Colorado, Wyoming, Montana, Iowa, Minnesota, and North and South Dakota. Also, in 1956, the material was applied on the Powell, Wyoming, airport, the first CAA approved airport to use rubberized cutback for runway sealing. Since then two other CAA approved airports have been "rubberized."

● In 1955, in cooperation with Husky Oil Company, the Wyoming Highway Department set up a controlled experiment west of Cody, Wyoming (results of this experiment reported in the November 1955 and January 1957 issues of *Roads and Streets*). The latest details on this experiment are presented here together with details on a joint test begun in 1956 by Husky and the Montana Highway Department. Data gathered on both experiments indicate distinct advantages of the rubberized cutbacks over the conventional asphalts applied on the test areas.

Research in the field of rubberized asphalt has revealed that not all rubber lattices are suitable for rubberized cutbacks. Consequently a rubber was selected which increased low temperature ductilities of the asphalt to the highest degree. The rubberized asphalt in the cutback possesses some remarkable qualities when the solvent ingredient is removed. It will have a ductility of 150 c.m. plus at 39.2 degrees F, whereas unrubberized asphalt is 8-12 c.m. Other properties are also improved, such as toughness and tenacity as described by

(Continued on page 157)

Practical Gradation Limits for Natural Aggregate Bituminous Concrete

The conclusion of a paper presented at the National Bituminous Concrete Association's third annual convention in Las Vegas.

By S. B. Hudson, Chief Engineer, Miller-Warden Associates

Results Reviewed

Series 1. Effect of Variation in Quantity of Plus 4 Aggregate

The first point investigated was the effect on the physical test properties of the mix, as indicated by the Marshall Method, caused by variations in the relative proportions of coarse and fine aggregate. This is one of the most common variables in the production of NABC as the quantity of coarse aggregate available varies with different deposits and with changes in the same deposit.

For this Series hot bin samples were separated into six (6) sizes and recombined into gradations shown in Fig. 4 and Table IV. Percent retained on the No. 4 screen was varied in 6 steps from 20 to 55 percent.

Test results are also given in Table IV and a stability versus gradation plot shown as the + line in Fig. 7. These results indicate that relatively wide differences from the basic gradation can be tolerated with respect to the quantity of aggregate retained on the No. 4 sieve, as indicated by the physical test properties, providing the asphalt content is properly adjusted. Comparison with the Corps of Engineers criteria indicates that satisfactory mixes can be obtained with variations of plus 7 percent and minus 11 percent from the basic gradation with these aggregates.

Series 2. Effect of Gradation of Fine Aggregate

The purpose of this Series was to determine the effect on the physical test properties of the basic NABC gradation, as indicated by the Marshall Method, of changes in the coarseness of the fine aggregate. Again hot bin samples were separated into six (6) sizes and then recombined to give the gradation desired. To avoid effects caused by variations in the filler content the minus No. 20 aggregate was washed and added filler material was used for the portion passing the No. 200.

For this Series the gradations tested are shown in Fig. 5 and Table V. The percent retained on the No. 4 screen (percent gravel) was held constant at 34 percent and the percent filler constant at 6 percent. The percent retained on the No. 20 sieve was varied in seven (7) steps from 49 to 79 percent.

Test results are also given in Table V and a stability verus gradation plot shown as the ⊙ line in Fig. 7. These data indicate that, with proper asphalt content, mixes of these aggregates having satisfactory physical properties can be obtained over the entire range of gradation investigated, i. e. from 14 percent more to 16 percent less of the total aggregate passing the No. 20 sieve than was used for the basic gradation.

Series 3. Effect of Variation in Quantity of Filler

The purpose of this Series was to investigate the effect on variation

To Our Readers!

Part I of this article appeared in the May issue of *Roads and Streets*, page 115.

Readers will probably wish to review it in order to obtain a complete view of the subject.

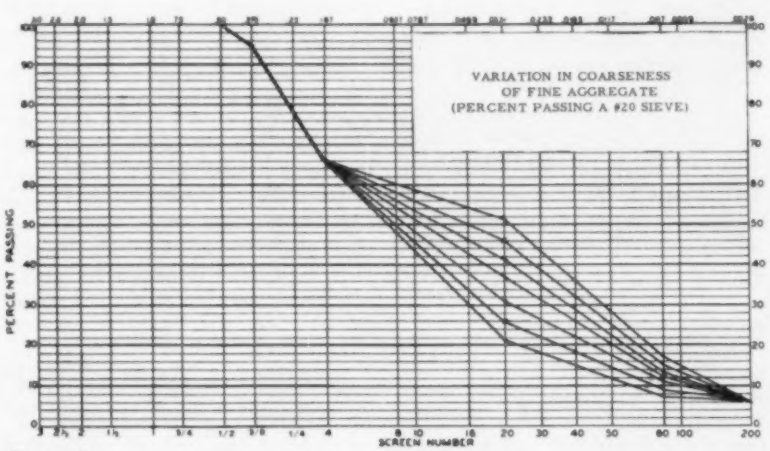


Figure 5

TABLE IV

Series 1. Effect of Variation in Quantity of Coarse Aggregate

(South Jersey Construction Co. Aggregates)

Mix and Batch Number	4-A	4-B	4-C	4-D	4-E	4-F
Percent asphalt (85-100) Total Mix	7.0	6.6	6.2	5.9	5.8	5.6
Percent aggregate only ¾-½	5	5	5	5	5	5
½-⅜	5	7	10	12	13	15
⅜-No. 4	10	15	19	23	29	35
Total retained on No. 4	20	27	34	40	47	55
No. 4-No. 8	13	13	11	10	9	7
No. 8-No. 20	21	19	18	16	14	12
No. 20-Pan	46	41	37	34	30	26
¾-Pan	100	100	100	100	100	100
Theoretical Specific Gravity of Mix	2.37	2.385	2.40	2.41	2.41	2.42
Bulk s. g. of specimens	2.24	2.27	2.28	2.30	2.31	2.34
Percent Voids Total Mix (V_t)	5.5	4.8	5.0	4.6	4.2	3.3
Percent Aggregate Voids (V_a)	20.7	19.4	18.7	17.8	17.1	16.0
Percent Voids filled with A. C. (V_f)	73.4	75.2	73.3	74.2	75.4	79.4
Weight lb./cu. ft. Total Mix (U_t)	139.8	141.6	142.3	143.5	144.1	146.0
Weight lb./cu. ft. Aggregate only (U_a)	130.0	132.2	133.5	135.0	135.7	137.8
Flow valve in .01 inches	8	7	8	7	7	7
Marshall Stability @ 140°F (Pounds)	1270	1390	1240	1380	1580	1500

from the basic gradation in the quantity of minus No. 200 material (filler). As in Series 1 and 2 hot bin samples were separated into six (6) sizes and then recombined to give the gradation desired. To accurately control filler content the minus No. 20 aggregate was washed and added filler (limestone dust) was used for all of the minus No. 200 material.

The gradations tested for Series 3 are shown in Fig. 5 and Table VI. This time the percent retained on the No. 20 sieve was held constant at 62 percent and the percent filler varied in six (6) steps from 0 to 10 percent.

The test results are presented in Table VI and a stability versus per cent filler plot shown in Fig. 7. It will be noted that filler content has a marked effect on stability as measured by the Marshall apparatus over the range tested. These data indicate that satisfactory mixes can be produced with variations of from minus 6 to plus 4 percent of the basic gradation.

Discussion and Summary of Test Results

These tests show that, when using these aggregates with the proper asphalt content, satisfactory mixes with respect to physical test properties can be produced over a fairly wide range of practical gradation limits above and below the basic gradation curve. Specifically the variables investigated with satisfactory results include those tabulated on page 135.

This does *not* mean that satisfactory mixes may be obtained if one goes from the low side of one sieve size to the high side of another. It does mean that this type of basic gradation curve is not critical for uncrushed natural aggregates and

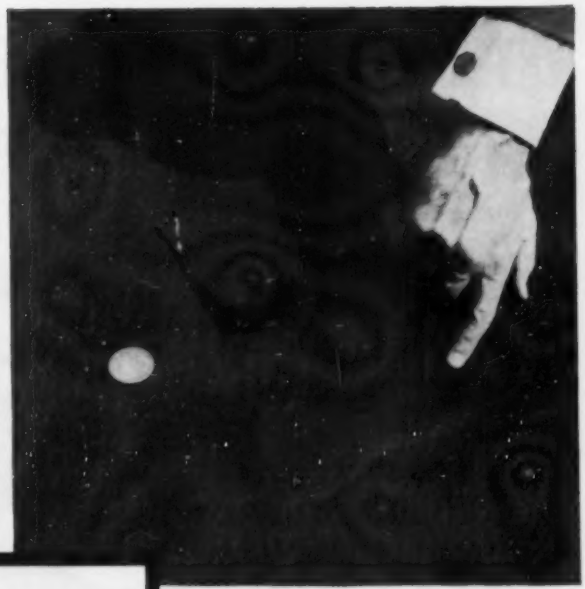
(Continued on page 135)

TABLE V

Series 2. Effect of Gradation of Fine Aggregate

(South Jersey Construction Co. Aggregates)

Mix and Batch Number	20-A	20-B	20-C	20-D	20-E	20-F	20-G
Percent asphalt (85-100) Total Mix	5.57	5.42	5.26	5.10	4.94	4.78	4.62
Percent aggregate only ¾-½	5	5	5	5	5	5	5
½-⅜	10	10	10	10	10	10	10
⅜-No. 4	20	20	20	20	20	20	20
No. 4-No. 8	6	8	10	12	14	16	18
No. 8-No. 20	8	11	14	17	20	23	26
Total retained No. 20	49	54	59	64	69	74	79
No. 20-No. 200	45	40	35	30	25	20	15
No. 200-Pan	6	6	6	6	6	6	6
Theoretical Specific Gravity of Mix	2.420	2.426	2.431	2.437	2.442	2.448	2.454
Bulk s.g. of Specimens	2.298	2.320	2.340	2.360	2.368	2.370	2.360
Percent Voids Total Mix (V_t)	5.0	4.4	3.7	3.2	3.0	3.2	3.8
Percent Aggregate Voids (V_a)	17.5	16.6	15.7	14.8	14.4	14.2	14.4
Percent Voids Filled (V_f)	71.2	73.6	76.2	78.7	79.0	77.5	73.4
Weight lb./cu. ft. Total Mix (U_t)	143.3	144.8	146.0	147.2	147.8	147.9	147.3
Weight lb./cu. ft. Aggregate Only (U_a)	136.3	137.0	138.3	139.7	140.5	140.8	140.5
Flow value in .01 inches	7	7	7	7	7	7	7
Marshall Stability @ 140°F (Pounds)	1110	1218	1367	1585	1627	1648	1558



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For Pavements in Rochester, New York

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LEFT: A typical section of pavement to be treated with Bitumuls Slurry Seal in Rochester. RIGHT: The same pavement section after treatment with Bitumuls Slurry Seal. (Note how the crack in the foreground has been sealed).

The City of Rochester, New York, was faced with a problem common to many communities today: keep all streets maintained in serviceable condition; yet do it at a cost that will permit the complete replacement (out of Maintenance Department funds) of many miles of streets that are over-aged.

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GRADATION LIMITS

(Continued from page 132)

therefore the potential for the wider utilization of more economical hot plant-mixes exists with attending advantages over the less durable surface treatments and mixed-in-place construction for certain pavement services.

The basic gradation curve is recommended for optimum job performance (lay down and compaction) on the basis of literature search and field experience. Variations from the curve within the limits explored in the laboratory tests can probably be tolerated in the field but this must be determined by actual laydown using the specific aggregates in question.

● The results of Marshall stability versus gradation for these variables are summarized in Fig. 7. It will be noted that all points are well above the minimum criteria of 500 lb. established by the Corps of Engineers, and in most cases above the 1000 lb. minimum recommended by Marshall (14) for wearing course for light to medium traffic requirements.

These and prior tests indicate that basically stability is primarily determined by the grain shape of the fine aggregate particles, but is greatly influenced by the quantity of filler, or minus No. 200, in the mix. Although there is a small increase in stability with an increase in the percentage of coarse aggregate in the mix, this increase above the minimum requirements is not necessarily advantageous because of the corresponding decrease in aggregate voidage.

It should be emphasized that stability is only one of the physical requirements for a satisfactory mix. The chief requirement for meeting the Corps of Engineers criteria is that the gradations produce sufficient and proper aggregate voidage. While some minor adjustments in asphalt content are admittedly necessary in a few cases to bring all of the mixes studied herein within the criteria in all respects, these data are sufficient for valid interpretation of voidage relationships. Although in theory the requirement that the total voids be within a range 3-5 percent for surface mixes and at the same time the voids filled with asphalt be within the range 75-85 percent can be met with an aggre-

Variables Investigated in the Test

Series	Variable	Measured by	Basic Gradation Point	Range Investigated
1.	Quantity of coarse aggregate	Retained on No. 4 sieve	34%	20% - 55%
2.	Gradation of fine aggregate	Retained on No. 20 sieve	62%	49% - 79%
3.	Filler content	Minus 200	6%	0 - 10%

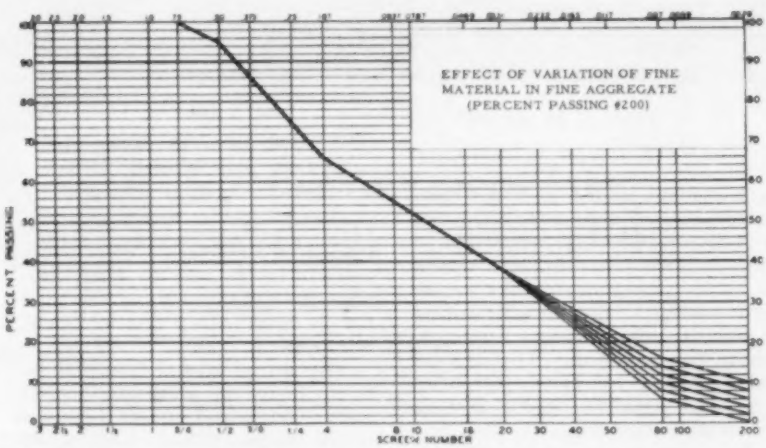


Figure 6

TABLE VI

Series 3. Effect of Variation in Filler Content

(South Jersey Construction Co. Aggregates)

Mix and Match Number	200-A	200-B	200-C	200-D	200-E	200-F
Percent asphalt (85-100) Total Mix	6.36	5.97	5.58	5.18	4.79	4.38
Percent Aggregate only ¾"-½"	5	5	5	5	5	5
½-⅜	10	10	10	10	10	10
⅜-No. 4	20	20	20	20	20	20
No. 4-No. 8	10	10	10	10	10	10
No. 8-No. 20	17	17	17	17	17	17
No. 20-No. 200	38	36	34	32	30	28
	100	98	96	94	92	90
No. 200-Pan	0	2	4	6	8	10
Theoretical specific gravity of mix	2.394	2.410	2.423	2.437	2.454	2.448
Bulk s.g. of specimens	2.241	2.271	2.301	2.342	2.363	2.386
Percent Voids Total Mix (V_t)	6.4	5.8	5.0	3.9	3.7	2.5
Percent Aggregate Voids (V_a)	20.2	18.9	17.5	15.7	14.7	12.7
Percent Voids Filled with A. C. (V_f)	68.4	69.5	71.2	75.1	74.8	80.0
Weight lb./cu. ft. Total Mix (U_t)	139.8	141.7	143.6	146.1	147.4	148.9
Weight lb./cu. ft. Aggregate Only (U_a)	130.9	133.2	135.5	138.5	140.3	142.4
Flow value in .01 inches	6	7	8	7	7	9
Marshall Stability @ 140°F (Pounds)	720	950	1110	1600	1770	2100

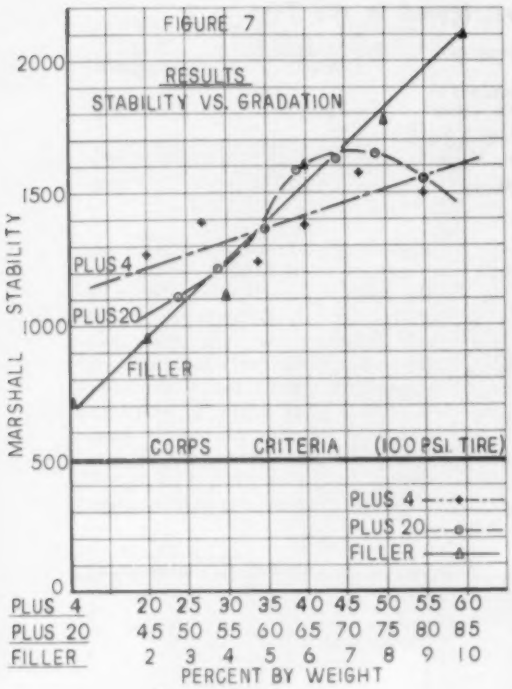


Figure 7

gate voidage as low as 12 per cent, normal variation in asphalt content and in the fine aggregate (No. 1 bin) in a commercial plant makes it highly desirable that the aggregate voidage be maintained at least 2 percent, and preferably 5 percent, above the minimum. This can be accomplished by using the basic gradation presented in Fig. 3 with reasonable tolerances.

In general, the investigational work and test results presented herein substantiate that mixes having satisfactory physical test properties can be obtained with a wide range of aggregate gradations within the gradation limits recommended by the Corps of Engineers (2). These limits are shown in Fig. 8. While the data shown for these South Jersey Construction Co. aggregates would indicate that these limits can be extended somewhat, the general practical gradation limits suggested for NABC are those given in Fig. 8. It should be understood, however, that the mix design should be checked for each new source of local, natural aggregate to arrive at the most economical gradation which assures a satisfactory mix for the intended service.

Costs Analyzed

It is realized that costs will vary widely in different parts of the country depending on availability of materials, number and location of plants, climate, etc. Still some discussion of relative costs would seem to be in order to better illustrate the advantages and the place for an intermediate quality NABC type mix.

The initial cost differential between high type plant mix bituminous concrete and surface treatment mixed-in-place construction is normally pretty well established in a given area. What apparently is not generally appreciated by the average Municipal or County Engineer is that even this difference is often completely absorbed by increased maintenance costs within a few short years. By using local material to best advantage in non-critical mixes following the general "W" type basic gradation curve, this initial cost differential can be further reduced for secondary roads and streets and still give the riding public the inherent higher quality pavement and much lower maintenance costs associated with plant mix construction.

A typical job of say 3,000 sq. yd. in New Jersey might be bid as follows:

Mixed-in-place and surface treatment

Construction is 6-in. sand-gravel base, the top 2 inches of which is to be mixed-in-place with 1 gal./sq. yd. of MC-2, followed by customary surface treatment. Quantities and costs are given in the accompanying breakdown.

ITEMS: Mixed-in-Place and Surface Treatment

Item	Quantity	$/sq. yd
Gravel for 6" base	—	0.4[illegible]
Mixing and blading	—	0.1[illegible]
Mix bitumen (top 2")	1 gal/sq. yd. MC-2	0.1[illegible]
Tack coat	0.25 gal/sq. yd. RC-2	0.04
Stone cover, 3/8" crushed stone	20 lb. sq. yd.	0.08
Seal coat	0.4 gal/sq. yd. RC-2	0.08
Stone cover	35#/sq. yd.	0.14
	Total Initial Cost	$1.05
2nd year — patching		.04
3rd year — patching		.04
4th year — surface dressing, reseal and cover		.20
5th year — patching		.04
	Total cost end of 5 years	$1.37

TABLE VII

Cost Comparisons

Method		Cost on 6" gravel base $/sq. yd Total Thickness	Cost at same thickness (6¼") $/sq. yd.	Cost on Old Road Base
Mixed-in-place		6¼"		
Initial cost	$1.05		$1.05	$ .75
Maintenance	.32		.32	.32
Total, 5 years	$1.37		$1.37	$1.07
NABC, initial (& total)	1.20	8"	1.09	.80
FABC, initial (& total)	1.60	8"	1.49	1.20

The pavement would carry a 5 year guarantee of no additional maintenance or repair costs.

NABC Construction

Item	$/sq. yd.
6" gravel base	0.40
2" NABC	0.80
Total Cost	$1.20

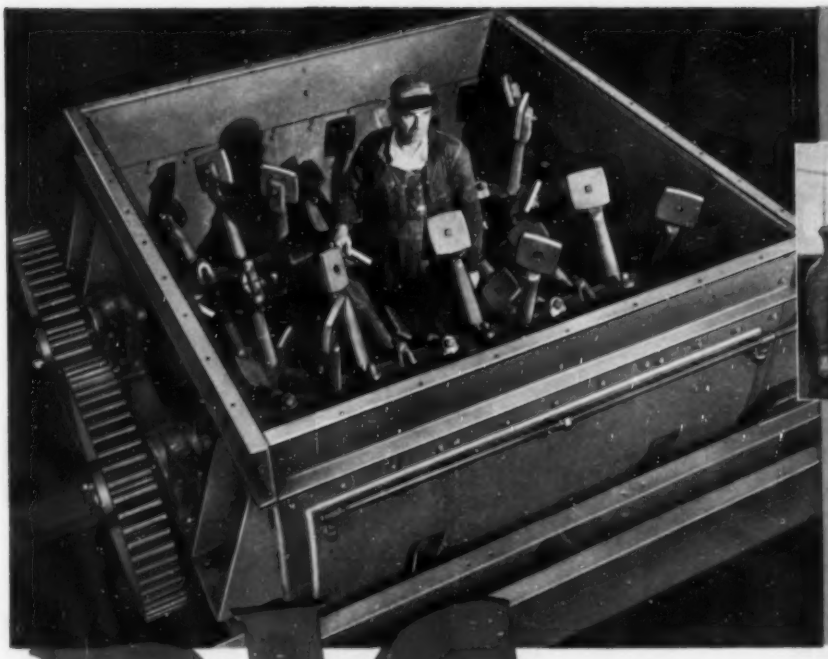
High type crushed stone mix—New Jersey FABC

Item	$/sq. yd.
6" gravel base	0.40
2" FABC	1.20
Total Cost	$1.60

Same guarantee

It will be noted that the total thickness for both the NABC and the FABC construction is 8 inches versus only about 6¼ in. for the mixed-in-place. While the 6" grav-

(Continued on page 139)



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GRADATION LIMITS

(Continued from page 136)

el base is felt to be desirable, the saving on this extra gravel to put the three types of construction on a comparable thickness basis would amount to about 11c/sq. yd. and still give a superior pavement.

If the job were to be done on an existing road base, the cost of the 6" of gravel would be saved in all three cases but it would cost about 10c/sq. yd. to scarify and reshape the old surface for the mixed-in-place method. The cost comparison on an existing road thus becomes:

Mixed-in-place	
Initial	$0.75/yd.
Total after 5 years	$1.09/yl.
NABC—initial (& total)	.80
FABC—initial (& total)	1.20

A summary of these cost figures are given in Table VII.

All of the costs shown in table VII, are, of course, subject to variation from job to job depending on a number of factors. In general, however, they represent the typical cost relationships in New Jersey among the three methods of construction. The cost advantage of NABC over either FABC or mixed-in-place is obvious and should be better understood and appreciated by all concerned.

Conclusions and Recommendations

Based on laboratory data, controlled traffic tests and field experience of the Corps of Engineers, the Garden State Parkway, the South Jersey Construction Co., and literature reference to others plus the new investigational work presented herein, the following conclusions may be cited:

1. Satisfactory plant mixes for light and medium traffic secondary roads and streets can be economically produced using uncrushed natural aggregates.

2. The optimum gradation curve, considering both cost and quality factors, approximates the "W" or well graded type and a basic gradation curve is recommended (Fig. 3).

3. This basic gradation curve when applied to natural aggregates is shown to yield mixes which are non-critical with respect to asphalt content and with respect to gradation tolerances. These mixes also handle well in the plant, on lay down and under the rollers.

4. The practical gradation limits for an uncrushed natural aggregate have been investigated over a wide range of percent retained on the No. 4 sieve, of degree of coarseness of the fine aggregate (No. 20 sieve), and of filler contents. The broad band of gradation limits recommended by the Corps of Engineers (Fig. 8) has been substantiated at these points and is confirmed for highway work.

5. Both physical test property studies and actual field service experience indicate marked performance and overall cost advantages over the less durable mixed-in-place and surface treatment construction customarily used for light and medium traffic pavements.

It should be understood that these NABC type mixes are not recommended as replacements for crushed stone or slag high type mixes normally specified for primary roads and heavy traffic duty. Nor are these intermediate quality mixes necessarily restricted to bank run natural aggregates, since other lower cost locally available materials may also be found to be suitable. The main point for Municipal and County Engineers, Contractors and

(Continued on page 142)

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Views and Comments

HEAVY DUTY PAVEMENT DESIGN

. . . By H. G. Nevitt

THE DESIGN of asphalt pavements for heavy duty use has been a cause of much concern in recent years. Doubts concerning the suitability of asphalt for this purpose—without real justification, in our opinion—resulted in the complete ban of this type for heavy loading Air Force use. The situation is still far from clear from the asphalt industry standpoint despite further tests, discussion and promising developments since that time. The prevailing views among those responsible for such pavements now favor a design of questionable merit in our opinion from the standpoint of durability; and in general technologists are far from agreement as to the best design for heavy loadings—which incidentally, seem specified in excess of realistic needs by the Air Force.

We do not feel that either the doubts still held by some as to the feasibility of heavy duty design with asphalt, or the present tendency toward abnormal design (such being our classification of very low asphalt content mats) are justified. We believe that a rather simple engineering analysis will confute these positions and, perhaps, prove of some interest to the general reader.

The need for heavy duty design results from the presence of either a total loading of great magnitude, high tire pressure, numerous load repetitions or some combination thereof. While the effects of these three conditions are to some degree interrelated, we believe that they can be considered separately with an accuracy sufficient for our purpose, with great simplification of the problem as a result.

● The effect of a heavy total load application is to greatly extend the depth and width of the stress effect. The depth to which suitable shear resistance must be correspondingly provided, and the width over which upthrust resistance must similarly be present are correspondingly increased. The effect of high tire pressure is to increase the maximum shear resistance needed at levels near the surface. The effect of more numerous repetitions is threefold. Pavement consolidation under traffic will take place more rapidly; so that, to obtain similitude between the laboratory specimens tested for suitability in resistance characteristics and the actual pavement during its use life, more intense laboratory compaction will be required, along with considerable certainty that the structure, degradation amount and other results of this laboratory compaction duplicate field conditions. Secondly, since the maximum resistance possible without failure decreases with the number of repetitions, higher specification or design standards are required for the same factor of safety. Thirdly, fatigue failures (or perhaps more correctly, the need for allowance for an average shorter stress relaxation period) will be more pronounced, with the same requirement of higher standards.

Proper Design Approach Will Meet Requirements

Are these greater requirements placed on the pavement beyond our ability to meet in a satisfactory and practical fashion? We believe not, and will try to support this contention by a discussion of the steps indicated for each.

The greater depth of stress penetration resulting from heavier loadings merely requires an increase in the thickness of the supporting layers, provided these are of suitable character, so that the shear intensity will be reduced to that permissible for the subgrade by the time this is reached. The increased width over which upthrust resistance must be provided simply calls for a thicker asphalt pavement with assured cohesive or beam resistance. Since horizontal shearing intensities are involved in this latter resistance, the thicker pavement (presumably constructed in layers) must have no planes of unusual weakness, such as between courses.

● The greater shear resistance in the top pavement layers called for by higher tire pressures can be supplied by a more uniform gradation, greater frictional resistance in the aggregate (and particularly in what we call in our own detailed design approach the Most Critical Aggregate Fraction) or both. And if the normally lower shear resistance of the deeper layers cannot be increased as the tire pressures go up, the depth of the higher resistance mat or upper layers must be increased so that the shearing stress has been reduced to an acceptable figure at the depth at which these less resistant courses are reached.

The needs imposed by greater load repetitions can likewise be met by suitable action. The greater compaction (along with comparable orientation and degradation effects) can be provided by suitable approaches. The new kneading compactor under study at Vicksburg is probably one, properly designed vibration equipment is another, and others are presumably possible. Recommendations previously made in these pages—testing of samples

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corresponding to the pavement condition at the end of construction, at the time of initial probable minimum subgrade support, and at the end of the design life period—are even more essential for heavy duty pavements.

The higher specification or design requirements should offer no problem. Many mixes today reach levels of frictional resistance and cohesion well beyond any requirements set by these heavy loading demands. It is true that in many situations a more critical inspection and testing of the mix components may be desirable, perhaps even involving techniques not in general use today. But there is no evidence that such techniques are not available, or that in the general situation the more severe specification requirements cannot be met. Similarly more exact and better controlled construction procedures may prove to be desirable, but here again there is nothing so far called for that cannot be readily made available.

The comments just made imply higher unit costs for such work. This is undoubtedly true, but this tendency should be more than offset by the benefits from working with larger quantities. We are confident that the lower final pavement cost so far obtained with the flexible type is an advantage that will maintain with these heavier loadings. For corresponding measures are required with the rigid type of pavement; in fact, the problems inherent in this type may become more severe. Some engineers who have dealt with both hold to the opinion that the economic advantage of the flexible over the rigid pavement will be found to improve as the loading, and with it soil movements and deflections, increases.

Must Maintain Durability

We earlier registered objection to the current trend to provide for these heavy duty conditions by low asphalt content mixes showing high density. Experience has clearly brought out that thin asphalt films do not always show the durability usually associated with this type pavement. The argument is offered that this will not hold with the very dense pavements obtained with this present design approach. We do not think this is correct: there has been plenty of evidence that quite dense pavements with thin films, built for other reasons than heavy duty loadings, crack and otherwise fail. Furthermore, in our opinion,

(Continued on page 159)

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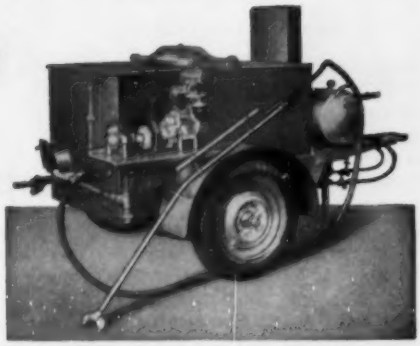

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GRADATION LIMITS

(Continued from page 139)

Producers alike is to better utilize suitable local materials, regardless of their source, to obtain the optimum balance between cost and service requirements.

Some of the well established advantages of hot mix are better control, greater uniformity, much better asphalt coating and adhesion, resistance to ravelling, water action and bleeding, and superior riding and durability characteristics. For many services, not subject to heavy traffic, all of these advantages of plant mix bituminous concrete can be fully realized by the better understanding and proper use of suitable local materials at an appreciable savings in some areas over premium aggregates and at a lower overall cost compared to the old in-place construction methods.

It is recommended that *local* Engineers and *local* Contractors and Producers work together to explore their own back yards for similar opportunities to provide more miles of superior pavement for the communities they service through optimum utilization of suitable *local* materials in hot mix construction.

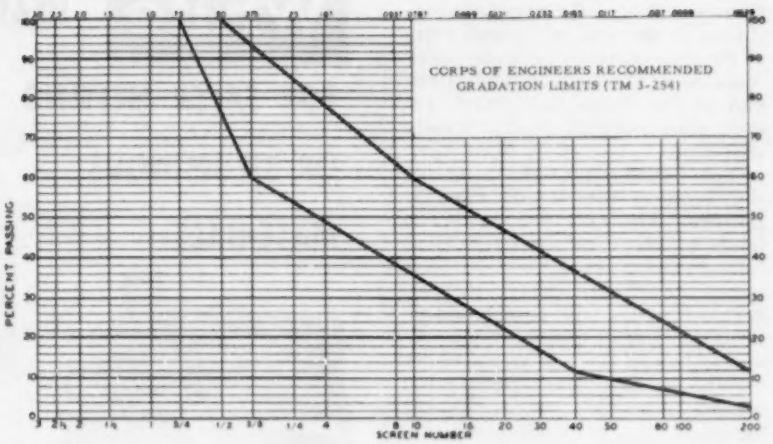

Figure 8

★ ★ ★

ACKNOWLEDGMENT: Miller-Warden Associates wishes to gratefully acknowledge the support of the South Jersey Construction Company for their co-sponsorship of the rather extensive and time consuming investigational work required to obtain the data presented in this paper. The financial and moral support of A. F. Marrazzo, Partner, and A. J. Piergross, Partner, and the cooperation of E. J. Parker, General Superintendent, C. W. Hall and others of the South Jersey staff is greatly appreciated.

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In last month's issue of *Roads and Streets,* it was reported that the Ohio Department of Highways had a record-breaking 1957 year, involving total outlay of $290.5 million in its highway program. This is one of the largest sums, if not the largest, ever handled by a single state in a single year except where toll road construction was included in the picture.

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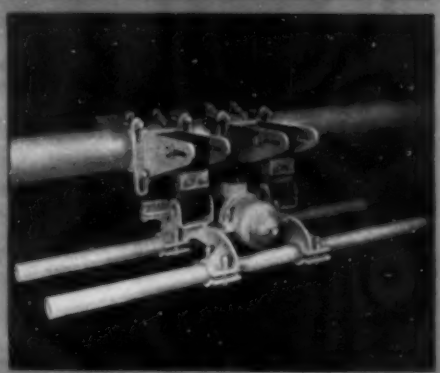

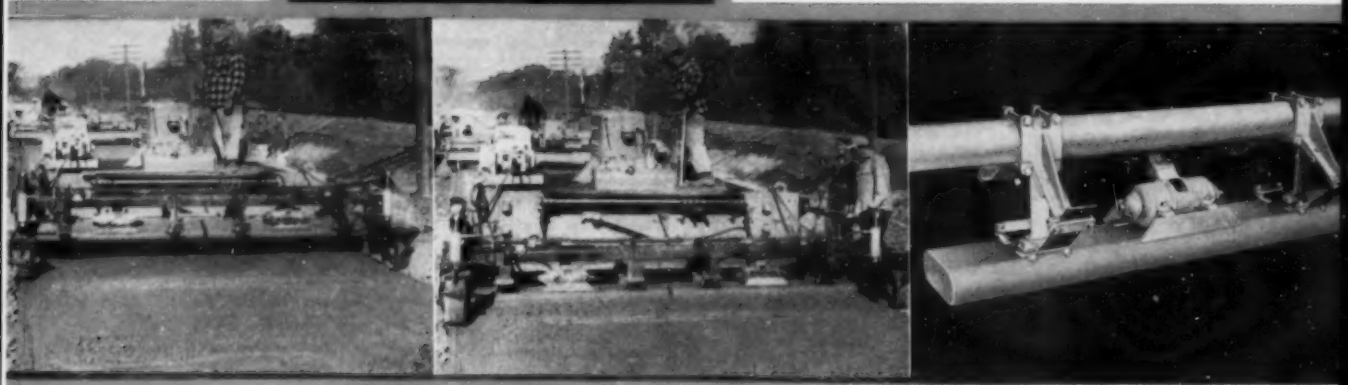

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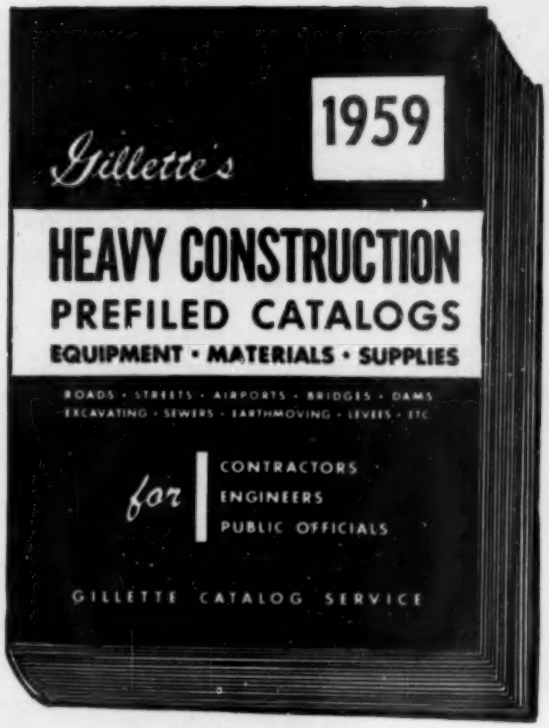

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RUBBERIZED ASPHALT

(Continued from page 130)

Benson in his article "New Concepts for Rubberized Asphalt."[1] Husky distinguishes cutbacks containing rubber from unrubberized cutbacks by the addition of the suffix "D" to the grade of cutback. For example: RC-3D is the rubberized counterpart of RC-3.

● *Study Methods.* A new test method for evaluating comparative sections of seal-coated surfaces was suggested by E. P. Erickson of the Bureau of Public Roads at Cheyenne. The technique, developed by R. V. Witter, a research chemist for Husky and a former research paleontologist with Princeton University, consists of taking an impression of the surface with moulding clay or similar moulage material and making a plaster cast from the impression in the laboratory. This technique has the advantage of providing a three-dimensional replica of the surface, which not only shows the roughness of the surface in relief but also provides an accurate record of chip loss and changes which may occur in the surface. It may be possible to correlate results obtained by this technique with skid resistance studies similar to those made by Shelburne and Sheppe.[2]

Another method used to evaluate rubberized and unrubberized seal-coated surfaces involved sweeping and weighing the chips that had been whipped to the roadside. This was done on both the Wyoming and Montana experiments. While the results indicated that rubberized sections retained more chips than unrubberized sections, an analysis of the data indicated that some areas had an almost total loss of chips, a condition not confirmed by visual examination of the surface. This method assumes a constant rate of chip application and that all chips on the side of the road were derived from an area defined by the center strips and the edge of the road. Such factors as wind, rain, snow removal, and variation in chip application, probably account, at least to a considerable degree, for the erratic results obtained.

A third method, using photographs of limited test areas to study chip rentention, is proving to be a valuable research tool in evaluating the holding power of rubberized asphalts. This method consists of permanently delineating areas of one square foot by driving aluminum nails into the pavement locating the four corners of the square. The square is then photographed after two weeks and periodically thereafter. The chip loss history of each square is developed by counting the chips which are missing in succeeding photographs.

Counting is facilitated by enlarging the photographs to three or four times natural size; or, by projecting the photographs onto a screen either from the negative or from the photograph, by means of a Baloptican or an Opaque type projection lantern which reflects the image onto a screen by means of mirrors.

● *Results to Date.* The Montana experimental test section was started July 24, 1956, on a 13.4 mile stretch of new paving on U. S. Highway 310 beginning just north of the Wyoming-Montana state line. Materials used are shown in the accompanying schematic diagram *(Figure 1)* with each section being 6,000 ft. in length. Sealcoating

---

1 Benson, J. R., "New Concepts for Rubberized Asphalts," *Roads and Streets,* April 1955.

2 Shelburne, T. E. & Sheppe, R. L., "Skid Resistance Measurements of Virginia Pavements" Res. Dept. No. 5-B of the Highway Research Board. 1948.

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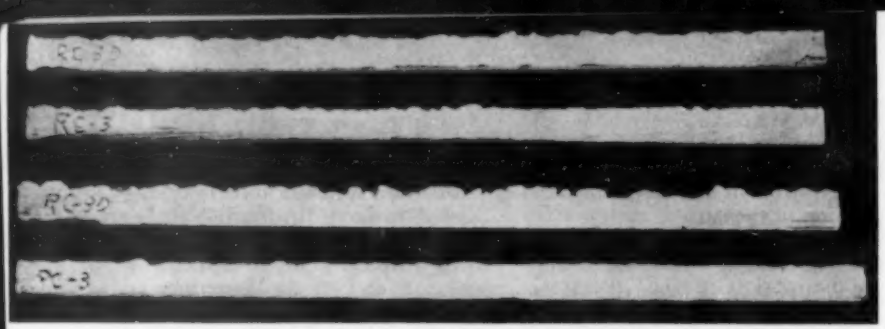

● **Figure 4. Profile of surface casts made of test sections on Wyoming test after two years. From top to bottom: rubberized asphalt, straightaway; unrubberized asphalt, straightaway; rubberized asphalt, curve; unrubberized asphalt, curve.**

was supervised by Layman Fox of the Montana Highway Department and laid by Peter Kiewit and Sons Co., Inc., of Omaha, Nebraska. RC-4D and Emulsion were shot on the first section at 0.3 gal. per sq. yd. with 26 to 28 lb. per sq. yd. of chips. Later test sections were cut to 0.25 gal.

● Evaluation of the Wyoming and Montana test sections by means of chip count studies, based upon the number of chips lost per square foot, is presented in the accompanying table. Note that the RC-3 curved area in Wyoming has lost about twice as many chips as the RC-3D curved area. The ripple effect of the RC-3 cast was caused by the moulding clay flowing as it was pressed onto the surface. The RC-3D provided enough traction to prevent the ripple effect from occurring. The roughness of the RC-3D and the smooth surface of the RC-3 are pictured in the two lower cross-sections shown in Figure 4. The two upper casts are of the straightaway section and reflect the chip count of 229 chips lost for the RC-3D and about one-third as many more lost for the RC-3. Thus, in both the chip counts and the photographs we can see the greater retention powers of RC-3D. The Montana test sections, as revealed in the accompanying table, show even a more pronounced effect of the rubberized cutback, the RC-4 having lost about 4 times as many chips per square foot as the RC-4D.

Finally, the marked tenacity and ductility of the rubberized cutback is graphically pictured in *Figure 5*. This "ant's-eye" view of a chip being pried loose from the rubberized section of the Montana test after one year, shows the chip still tied to the pavement by many independent cables of tough strands of rubberized asphalt.

● *Summary.* New materials always present new problems of evaluation. New "yardsticks" have to be devised and tested. Probably the most difficult of all road materials to test under field conditions are seal coats. Factors such as road temperature, chip temperature, and moisture content, air temperature and weather conditions, asphalt cutback temperature, and curing conditions, are the variables which may determine whether a seal job will fail or succeed. Experience with rubberized cutbacks used for seal coating roads has proven that success is greatly increased by the use of such materials.

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PAVEMENT DESIGN

(Continued from page 141)

the very dense low asphalt content mat lacks two of the critical characteristics of a good pavement of this type, namely, flexibility and fatigue resistance.

The stability values for these thin film designs are extremely high. But there is no proven need for values at this level. If after considerable exposure to traffice the pavement will not flush or display plastic flow due to lack of void space, it will, in a structure of proper thickness design, carry these loads at reasonable and obtainable values for frictional and cohesive resistance. Suitable aggregate can be obtained. Likewise gradations are possible which will bring about this result; they simply must be balanced, have asphalt films of sufficient consistency and thickness, and provide after full compaction the necessary void room for the asphalt required. Furthermore the construction procedures must be consistent with the design, turning over to traffic structural layers of sufficient initial resistance at all pavement depths to counteract the stresses penetrating to these depths.

● In brief, heavy duty pavement design mainly requires adaptation of known information and techniques to the situation. With this there will probably be need for design refinements and attention to detail to a degree not previously usual; but there is no reason to believe either that a final satisfactory result is not obtainable, or that it will involve the abandonment of thoroughly proven concepts, such as that unusually thin films must be accepted even though the durability of the pavement is thereby thrown into question.

The situation here is no different than those which have arisen in other fields of structural design, such as for continuous spans, skin resistant bodies, and similar. The additional requirements simply call for additional use of the tools of the profession, primarily the application of engineering analysis with greater detail and precision to the more elaborate problem. And we suspect that the final result will be the same as for these other structures—namely, that in addition to developing the ability to meet the greater needs, the resulting approach will lead to more accurate and economic designs even in areas not at present a source of concern. Perhaps, in fact quite probably, the need to solve these problems of heavy loadings will force us to steps already desirable for other reasons if we are to fully live up to our obligation to provide the most structural resistance for the least money.

THE AMERICAN WELDING SOCIETY in April elected Gustav O. Hoglund, head of the welding section of the Aluminum Company of America, process development laboratory, as President, and Charles I. MacGuffie, Manager of Marketing of the Welding Department of the General Electric Co., as First Vice President. Presentation to the membership was made at the opening ceremony of the 39th Annual Meeting of the Society in the Statler Hotel, St. Louis, Missouri, on April 14.

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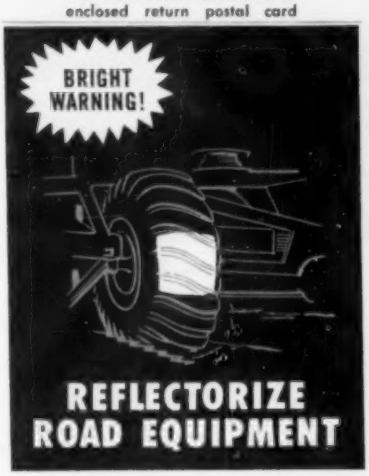
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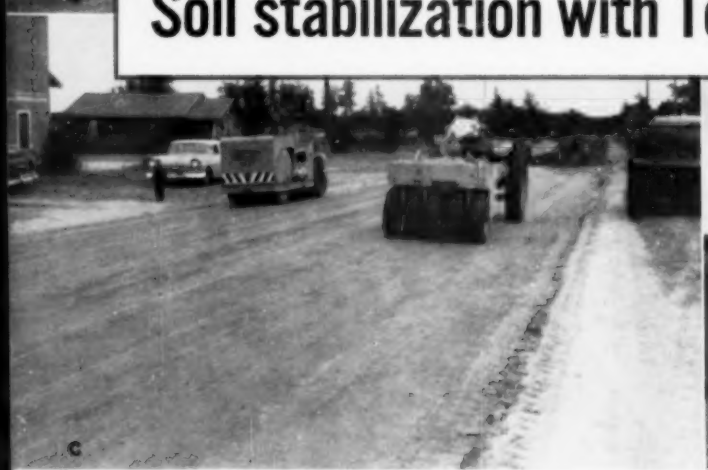

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b. Pulvi-mixer and motor grader blend Cutback Asphalt and soil.
c. Compacting Texaco-treated soil with multi-wheel and tandem rollers.
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